



Agriculture, Fisheries and Environment Sub-Committee

Innovation in EU Agriculture

Oral evidence with associated written evidence

InCrops.....	1
Written Evidence (IEUA 21).....	1
Oral evidence, 3 November 2010, Q 1–37.....	10
Supplementary written evidence (IEUA 33).....	30
Agriculture and Horticulture Development Board (AHDB) and the John Innes Centre.....	34
Written evidence from AHDB (IEUA 2).....	34
Written evidence from the John Innes Centre (IEUA 22).....	37
Oral evidence, 10 November 2010, Q 38–106.....	41
Supplementary written evidence from the John Innes Centre (IEUA 32).....	67
Rothamsted Research	70
Written evidence (IEUA 17).....	70
Oral evidence, 17 November 2010, Q 107–143	82
Country Land and Business Association (CLA) and the National Farmers Union (NFU)	101
Written evidence from the Country Land and Business Association (CLA) (IEUA 6)	101
Written evidence from the National Farmers Union (IEUA 14).....	105
Oral evidence, 1 December 2010 (am) Q 144–178.....	110
Supplementary Memorandum by the National Farmers Union (IEUA 34)	125
US Department of Agriculture.....	127
Oral evidence, 1 December 2010 (pm), Q 179–197	127
Mr Paolo De Castro MEP.....	142
Oral evidence, 8 December 2010, Q 198–222	142
ADAS	156
Oral evidence, 15 December 2010, Q 223–275	156
National Institute of Agricultural Botany (NIAB) and Professor David Leaver	171
Written evidence from NIAB (IEUA 28)	171
Oral evidence, 12 January 2011, Q 276–321	176
Scottish Agricultural College (SAC)	193
Written evidence (IEUA 19).....	193
Oral evidence, 19 January 2011, Q 322–354.....	210
Agricultural Biotechnology Council, GM Freeze, Soil Association and Syngenta.....	225
Written evidence from Agricultural Biotechnology Council (IEUA 1)	225
Written evidence from GM Freeze (IEUA 11)	230
Written evidence from Syngenta (IEUA 23)	240
Oral evidence, 26 January 2011, Q 355–414.....	247
Supplementary written evidence from the Agricultural Biotechnology Council (IEUA 35)	
.....	272
Supplementary written evidence from GM Freeze (IEUA 40).....	273
Supplementary Memorandum by Syngenta (IEUA 36)	285
National Institute for Farming and Food Investigation and Technology of Spain (INIA).....	287
Written evidence (IEUA 12).....	287
Oral evidence, 2 February 2011, Q 415–436	290
Supplementary written evidence (INIA) (IEUA 37).....	306

VISIT...

LANZAROTE
Caliente.COM

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?	312
Written evidence from Food Standards Agency (FSA) (IEUA 27).....	312
Written evidence from Wm Morrison Supermarkets plc (IEUA 31).....	316
Oral evidence, 16 February 2011, Q 437-476	319
Mr Uffe Sveistrup, Danish Agriculture Attache.....	341
Oral evidence, 2 March 2011, Q 477-509	341
Supplementary written evidence (IEUA 39)	349
European Commission.....	354
Written evidence (IEUA 29)	354
Oral evidence, 2 March 2011, Q 510-540	364
Polish Agricultural Attache	376
Oral evidence, 2 March 2011, Q 541-564	376
DG Research and Innovation	386
Oral evidence, 2 March 2011, Q 565-581	386
Dutch Government	397
Oral evidence, 2 March 2011, Q 582-604	397
Supplementary Memorandum by Frits Thissen, NL Agriculture Counsellor (IEUA 38) ...	409
COPA/COGECA	411
Oral evidence, 2 March 2011, Q 605-629	411
INRA, Scottish Agricultural College, Wageningen University and Research Centre.....	417
Oral evidence, 9 March 2011, Q 630-641	417
Professor Charles Godfray	432
Oral evidence, 16 March 2011, Q 642-672.....	432
Department for Environment, Food and Rural Affairs (Defra)	447
Written evidence (IEUA 25)	447
Oral evidence, 23 March 2011, Q 673-710.....	462
Supplementary written evidence (IEUA 41)	478
John Deere	481
Oral evidence, 6 April 2011, Q 711- 737	481

InCrops

Written Evidence (IEUA 21)

Introduction to InCrops - Science for business, not science for scientists

The Innovation in Crops (InCrops) Enterprise Hub www.incropsproject.co.uk is a company wholly owned by University East Anglia and backed by the European Regional Development Fund (ERDF) and the East of England Development Agency (EEDA).

InCrops is based on the Norwich Research Park, with thirteen research partners across the country. It works with research establishments, businesses and entrepreneurs to commercialise new products and develop new supply chains in crop based bio-renewables including alternative and non-food crops¹. Low carbon growth is central to the work of the InCrops enterprise hub which:

- Closes the gap between research, technology and commercialisation
- Initiates near market research when needed for specific product/business development
- Provides knowledge transfer to SMEs (over 100 businesses in the first 18 months), linking them to relevant research partners
- Works with large companies to develop working partnerships with entrepreneurs
- Helps access to venture capital by making new technologies investment ready
- Develops networks and relevant partnerships to exploit the existing research base
- Develops international partnerships

InCrops promotes science for business and not science for science's sake. All the objectives and delivery are focused on maximising the translation of cutting edge science into new commercial products which benefit the consumer and supplier whilst delivering more sustainable supply chains.

The response below draws on the experience of InCrops and its partners in facilitating innovation in agriculture, and is structured to address the eleven questions posed in the consultation. The case studies referred to in the text are all contained within a separate appendix.

1. Definition of “innovation” in the agricultural context

- a) Innovation requires step change as well as incremental change, to meet the challenge of making major shifts in products and production to address potential climate change and food security issues. Public sector led organisations often favour incremental change and do not tend to engage in and encourage more disruptive innovation.
- b) Innovation in relation to both productivity **and** the management of environmental impact are equally important to the future success and sustainability of the agricultural sector.
- c) Innovation in the agricultural sector must include innovation in management and marketing systems as well as in technical areas. This is needed in the management of supply chains, the development of new products and improvements in production methods.

¹ The InCrops partnership includes: Institute of Food Research (IFR), John Innes Centre (JIC), Norwich Research Park, Rothamsted Research, Buildings Research Establishment (BRE), National Institute of Agricultural Botany (NIAB), University of Essex, University of Cambridge Department of Plant Sciences, Renewables East, Easton College, Forestry Commission, University of East Anglia (UEA) School of Biological Sciences and the Low Carbon Innovation Centre at the UEA.

2) Innovation in EU agriculture as a strategic objective

- a) It is critical that EU agriculture proactively embraces innovation so that the sector maintains or enhances its economic competitiveness and addresses sustainability challenges.
- b) Agricultural innovation is not separate from other research areas. Many of the most important innovations will occur in areas where agriculture interacts with other businesses in the food sector, renewable material, energy or resource industries.
- c) The agricultural sector also needs to collaborate with other industry sectors to improve its sustainability by utilising innovations from biotechnology, engineering, chemistry, informatics, robotics and similar research areas.
- d) A strategic objective must be the development of an approach that treats crops as bio-refineries (as replacements to petrochemical refineries), using biological processes to provide a range of products and chemicals in addition to food and energy. InCrops is working on the establishment of an **Algal Innovation Centre** as described in Case Study 1 below to address this objective.

3) Innovation today

- a) The initial development and deployment of new technologies requires applied research teams who work closely with potential end users who are enthusiastic 'early adopters', either within their own organisations or elsewhere. This type of innovation requires risk funding (grant or commercial, and a willingness by both researchers and end users to work collaboratively).
- b) The roll out phase of innovation, when a successful innovation is applied on a wider basis, requires a positive attitude to change in the target businesses, an effective dissemination process and adequate funding. It must also be capable of adoption by most target businesses without major disruption to their production.
- c) A good example of where innovation would be helpful but has been constrained is in relation to renewable energy technology such as Anaerobic Digestion (AD). Continued regulatory problems firstly over waste licensing, and more recently (ongoing) confusion over the ability to obtain grant aid and double Renewable Obligation Certificates (ROCs) have seriously restricted the deployment of AD technology in the UK compared to other EU states.
- d) Pro-active encouragement is essential, for example, in the past the pea industry innovated rapidly through central council grants that encouraged collaborative developments and innovation in harvesting, processing, contracts and industry structure resulting in an innovative and highly commercial industry. Conversely, Hemp a traditional English crop died out because it did not innovate. InCrops is currently working with **Hemp Technology Limited** to increase the competitiveness of the Hemp crop in UK growing conditions through improvements to harvesting and seed choice as well as the development of new markets for hemp based products as described in Case Study 2 below.

4) Obstacles to innovation

- a) The UK is a global leader in research for agriculture, the food chain and associated sciences, with the John Innes Centre (an InCrops partner) being ranked number one globally in a 2010 survey by Times Higher Education based on the number of citations in the previous decade. Whilst maintaining research funding is critical to maintaining research excellence it is not the major obstacle to innovation in the UK given the depth and breadth of our research base.

- b) The loss of applied and demonstration farms, the lack of resources for farm extension and a concentration of research funding only on RAE published papers, has undermined the UK's capacity to commercialise its World Class research base. A lack of effective communication between innovators and commercial businesses and poor communication and dissemination activity restricts the take up of new developments.
- c) Intellectual property (IP) rules far from blocking innovation, allow both researchers and commercial businesses which invest in research to benefit from their discoveries and thus support investment in innovation.
- d) Most businesses in the agricultural sector are innovation hungry in relation to process improvements, and successful innovations tend to spread rapidly given the strength of the trade press and informal networks in the industry. However, more risky new product innovations do not tend to have as many willing innovators given the higher risk profile of such innovations.
- e) The UK Forestry sector has been in decline due to falling timber prices and poor market development which has restricted farmers' enthusiasm to plant new areas of commercial forestry. The result is that the UK is the 2nd largest global importer of timber, with imports of \$11bn per annum. Whilst prices have risen in recent years, UK timber production is still too focused on large volume but low value markets such as the demand for fencing materials. InCrops is working with the Forestry Commission and the industry to identify ways to use UK timber in construction, furniture and other high value uses to make UK production more viable.

5) **Demographic structure of the sector**

- a) There are very few incentives to get young people into the sector, and this is widely recognised as a major constraint on future growth. Work in the 2008 Labour Force Survey has shown that the sector is seen by those within it as taking longer to become competent within than other sectors. There is also a mistaken perception that most jobs in the sector are still low skilled with poor rewards. Tackling these perceptions is central to any policies on sector development.
- b) InCrops is supporting the University of East Anglia and Easton College of Agriculture in the development of the Centre for Contemporary Agriculture to develop high level training in business management, entrepreneurship, technology and innovation for the agricultural sector.

6) **Future challenges driving innovation forward**

- a) The biggest driver will be market demand both in terms of total demand (for food, feed, fuel and renewable materials), but also in changes in the types of product demanded by customers.
- b) The second major driver of innovation will be resource constraints in relation to scarce resources such as water and some inorganic nutrients (fertiliser ingredients), as well as the increased cost of other inputs such as energy. Moves to reduce dependence on the oil based economy will lead to biological systems replacing a wide range of oil derived goods and products. At its most innovative this means algal production not conventional crops as described below in case study 1 on the **Algal Innovation Centre**.
- c) The regulatory environment and concerns about the impact of some traditional products e.g. synthetic crop production products, will also drive innovation. Given the withdrawal of many active ingredients and growing consumer concerns there will remain a pressing need to develop new products with a lower environmental impact. For example InCrops is assisting **Barrier Biotech Ltd**, a micro SME to develop new

innovative plant protection products derived from natural ingredients as described in case study 3 below.

- d) These innovations will be delivered by aligning the interests of commercial businesses with those of researchers and supply chain businesses (both up and downstream). To do this it is essential that the environment (government policy, regulation, tax and grant aid) and processes used to support innovation are flexible and responsive so that they can quickly accommodate a wide range of constantly changing industry needs.

7) **Knowledge and innovation systems**

- a) The most important component of successful innovation systems are the businesses which implement new ideas. Without implementation, innovation remains at best an academic curiosity and it is therefore essential that businesses are seen as central to the 'innovation supply chain'. Businesses along the supply chain (producers, retailers, advisers) have a commercial imperative to innovate to respond to changing customer needs and environmental pressures, and the role of government must be to facilitate a proactive response by business.
- b) The success of the InCrops model of innovation suggests that there are a number of factors which help to drive innovation in the agriculture sector:
 - i) *Tailor made and flexible* - systems of innovation support need to be able to respond individually to each business 'customer' in a way which meets their needs.
 - ii) *Timescale* - most innovations take time to come to market, and support programmes must support companies for between 3 months and 3 years - depending on their needs.
 - iii) *Delivery partnerships* - these are key because most companies need a range of support which is unlikely to be available from a single advisor or research partner. Uniting advice from a range of sources is essential to support successful interventions.
 - iv) *Specialist staff* - InCrops Business Innovation Managers are based in key research institutes, working alongside scientists, but they are judged on the support they provide to businesses in terms of new start-ups, new products and new supply chains, rather than on research papers. They are commercial people able to bridge the gap between science and business.
 - v) *Proactive support* - successful innovation cannot be facilitated by publicising research alone. The number of innovations commercialised can be increased by proactively identifying potential partners, and creating the conditions for them to meet, exchange ideas and collaborate. This is particularly important in areas where new markets are proposed.
 - vi) *Business led and business focused* - innovation programmes need active business engagement in their design and management to ensure they stay focused.
 - vii) *Funding* - ultimately most innovation must be funded by business to ensure there is a clear economic case. Government can however help to increase innovation by targeted grants or incentives (e.g. tax breaks), which encourage businesses to invest in new technology.

A similar structure to InCrops exists in Germany, the **Fraunhofer Institutes**, and InCrops has signed a Memorandum of Understanding with one of these institutes to collaborate on applied research programmes as described in case study 4 below.

8) **Research and Development**

- a) The UK needs to ensure incentives for businesses to invest in R&D are strong enough and administrative burdens to access funding as low as possible. In the light

of the current budgetary position Government investment must focus on areas which show good returns on investment and which can be commercialised in the UK.

9) **Education and skills**

- a) There has been a long term decline in the numbers of agricultural students in practical, scientific and advisory disciplines in parallel with the more general decline in STEM (Science, Technology, Engineering and Mathematics) subjects. The new **Centre for Contemporary Agriculture (CCA)** which is closely linked to InCrops is addressing this by uniting research, academic and practical skills provision to make it easier to facilitate both the entry of new people into the sector and to promote career progression through a strong programme of continuous professional development as described in case study 5 below.
- b) Businesses, advisors and research centres across the sector report a major problem in accessing the workforce needed for managerial, technical and research functions, with a series of June 2010 business meetings in the East of England highlighting this issue strongly.²

10) **Knowledge transfer**

- a) Technology transfer needs partnership based solutions of the type used by InCrops as set out in section 7 above. These partnerships need robust business input to help set policy and design programmes. Success is dependent on having staff with excellent skills in technology translation who are equally comfortable working with scientists and senior business managers.
- b) Professional and trade organisations (e.g. NFU, CLA, AHDB) can play an important role in helping to reach large numbers of farm businesses on generic areas such as energy, waste and mainstream crops and livestock production.
- c) The public sector should build a requirement for knowledge transfer into all research contracts. The public sector can also help set a policy framework which gives businesses the confidence to invest e.g. investments in sustainable building products are dependent on future building regulation policy, investments in new food products are dependent on future food policy etc.

11) **EU policies**

- a) The forthcoming reform of the CAP can be used to assist continued innovation in agriculture, by encouraging competitiveness and continuing the move to a more market focused policy. This implies a continuation of decoupling and the removal of quotas or other market controls which restrict innovation.
- b) The Rural Development Programme should more explicitly support innovative crops and livestock products through a stronger focus on market development, supply chain development, knowledge transfer and skills.
- c) EU research policy and the Framework Programme (FP) for R&D have a key role in helping businesses to tap into the total EU research base. By co-ordinating, disseminating and building capacity across the EU the FP can help to promote the competitiveness of EU agriculture.
- d) Local and national networks are needed for SMEs to engage with, because the majority of smaller businesses would not themselves participate in transnational projects. However, those running local or national networks must be active participants in international networks so that the innovation communicated to businesses draws on all available new technology. For example InCrops is working

² The Skills Challenge of a Growing Sector: report on the skills needs of the Agri-food sector, June 2010, East of England Sustainable Farming and Food Group and East of England Development Agency

with Tamil Nadu Agricultural University to develop new approaches to fertiliser which can benefit UK farming, as described in case study 6 below.

Conclusions

InCrops believes that there is a growing need for innovation in EU agriculture and that the definition of innovation needs to be broad and flexible as proposed by this enquiry. At its core is the need for agriculture to increase its productivity of food, feed, raw materials for industry and ecosystem services whilst using resources more efficiently. To accomplish this increase in performance the sector must embrace innovation by improving its connection with research and development so that more research is commercialised.

Successful innovation led change must be:

1. **Market led** - so that the technologies and new management approaches utilised deliver a commercial return so that they are sustained.
2. **Business led** - so that businesses have a clear input into developing programmes and working with delivery bodies to ensure that innovation support meets their needs.
3. **Focused on knowledge transfer** - whilst some very innovative businesses in agriculture will want to directly engage with scientists to undertake blue sky or cutting edge research directly, the majority will in the main want to utilise existing research to improve processes or products. Focusing on knowledge transfer will thus benefit more businesses and has a faster payback for the country.
4. **Based on robust knowledge transfer skills** - without staff with both research and commercial skills knowledge transfer is greatly reduced, and innovation systems have to recognise and support the acquisition of specific skills in technology translation.
5. **Focused on partnership solutions** - so that the relationship between businesses and providers (advisors, researchers and others) is long term, and to allow businesses to access a suite of advice from a range of advisory bodies to meet their needs.
6. **Be facilitated with clear incentives and a supportive policy framework** - government can support innovation by ensuring that policy, e.g. the CAP and national and EU research policy, support a competitive and proactive agricultural industry which can embrace new technology. Where incentives (grants or tax breaks) and support (knowledge transfer services) are provided these must be as flexible as possible to facilitate maximum take up by businesses, with fast turn round and simple approval processes to help businesses access support.

Appendices - Case Studies

Case study 1 – Algal Innovation Centre

InCrops is co-ordinating the development of an algal innovation centre to investigate the economic growth opportunities for algae technology in the UK. Algae produce 10 times more biomass per hectare than conventional crops, and can be grown in environments not utilised by crops, from sea water to waste water (including the liquid residues from Anaerobic Digestion). Processing of algae can produce building block chemicals to produce a wide range of products, so replacing petrochemicals (e.g. some aviation fuel is already being made from algae), and can also provide protein for animal feed. But work is needed to commercialise the research and develop systems to reliably deliver algal based products. InCrops is in the advanced stages of planning an Algal Innovation Centre to bring algal technologies to the mainstream and unlock their potential to contribute to a green economy in the UK. The Centre is likely to be located outside Cambridge to build on the R&D capability of Cambridge University's Biologists and Engineers and their Algal Bioenergy Consortium. The work of the Centre will be driven by input from businesses planning to

adopt algal technologies, be it for bioremediation, generation of bioenergy or for higher value applications such as proteinaceous animal feed, nutraceuticals, cosmeceuticals or general platform chemicals.

The Centre will act as a hub which can test different technologies at a 500litre pilot scale, train the workforce needed to operate sustainable and profitable algal growth facilities, and translate novel technologies into application. Existing and developing algal growth facilities will be linked to the hub so that new technologies are translated as soon as possible. The Centre itself will be part of a Europe-wide network of Algal Growth Facilities kick-started through a Strategic Initiative on Algae by the INTERREG Programme in NW Europe. This pan European approach will help to reduce research duplication and ensure that knowledge is effectively shared across Europe so that the whole European industry gains.

Case Study 2 - Hemp Technology Limited

Hemp is a very adaptable low input plant which can be used for many end uses, but which had declined for many years as new synthetic products were developed. Due to a lack of research production techniques and seed variety choice were very limited. Following a major investment in new processing technology by Hemp Technology Limited, InCrops is working with the business to address many of the strategic issues facing the crop:

- Seed variety availability is limited, but trials by InCrops at Easton College are helping to test which are the best varieties for UK conditions;
- Harvesting is difficult and costly, but a new harvester developed jointly by Hemp Technology with Easton College, a commercial contractor and InCrops looks set to transform this process;
- New hemp based products can deliver large carbon savings and improve product performance and InCrops and Hemp Technology are collaborating to develop and commercialise a wide range of new products for the building sector (e.g. Hemcrete or fibreglass replacements) and automotive components.

Case Study 3 – Barrier Biotech Ltd

Barrier Biotech Ltd, a micro SME is a practical example of hi-tech research being used in an innovative way to develop a new product in agriculture. Barrier Biotech has previously successfully manufactured products for animal healthcare based on plant-derived active ingredients. Using its technical knowledge and 20 years of experience in essential oils, Barrier Biotech Ltd is expanding into other markets having licensed the UK's first environmentally friendly herbicide in 2000. In 2009, Barrier Biotech Ltd embarked on a project to develop novel nematicides. Damage caused by nematodes worldwide is estimated annually at £53-82 billion.

New formulations based on essential oils will target nematodes affecting arable root crops and substitute existing chemical nematicides coming off the market due to changes in the Plant Protection Products Directive (91/414/EEC). The new products could be used by farmers to maintain/improve yields of arable root crops following withdrawal of 91/414/EEC approval. The essential oils used in this formulation come from sustainable sources and represent a minimal risk to the environment.

The InCrops Enterprise Hub facilitated interactions with experts in entomology from the John Innes Centre and assisted the business in a successful grant application for funding from the “Novel Approaches for Crop protection” call from the Technology Strategy Board under the Sustainable Agriculture and Food Innovation Platform. A press release is available at: <http://www.innovateuk.org/assets/pdf/press-releases/press%20release%20cropprotection%20results%201jul10%20final.pdf>

The project on “Novel nematicides based upon plant oil formulations” will be delivered by Barrier Biotech Ltd, Syngenta Limited, and the John Innes centre, with the InCrops Enterprise Hub providing project management.

Case study 4 - Fraunhofer Institutes

InCrops has signed a Memorandum of Understanding with a German Fraunhofer Institute and plans to develop a series of joint projects to commercialise new novel crop derived products.

The Fraunhofer Gesellschaft (German, Society) is an excellent example of innovation and translational infrastructure that bridges the gap between research and technology commercialisation in all sectors of the German economy including agriculture. There are 59 Fraunhofer Institutes around Germany and several Fraunhofer Centres abroad, but none in the UK. The funding and innovation model is that Fraunhofer Institutes receive around one third of their budget as core funding, and aim to generate a further third through competitive bids to regional, national or EU public research projects, and a final third from research contracts with the private sector. They frequently focus on a sector or technology rather than have a wider spread of investments in many technology or sectoral fields. InCrops visited Germany in July 2010 and signed a Memorandum of Understanding with one of the Fraunhofer Institutes –Institute for Mechanics of Materials in Halle. InCrops will develop a series of potential projects for FP7 funding with Halle and is also aiming to establish a UK presence for Fraunhofer Gesellschaft.

Case study 5 – Centre for Contemporary Agriculture

The Centre for Contemporary Agriculture (CCA) has been established to bridge the gap between the industry, education and research in agriculture to facilitate improved academic provision, more applied research and an active programme of knowledge transfer.

The CCA represents a collaboration between the University of East Anglia and Easton College which is supported by partner institutes including the John Innes Centre, the Institute of Food Research, and The Sainsbury Laboratory in Norwich, and the National Institute for Agricultural Botany and The Arable Group (NIAB-TAG).

Much of the formal education and training will be based in Norwich where the University and College are based. However education, training and research in collaboration with the Agri-food industry is delivered in conjunction with businesses through short courses and placements across the country. For example, the CCA is working with Landskills East, a Rural Development Programme for England (RDPE) funded initiative, to increase the skills of the agri-food workforce by offering short industry courses in leadership and management with a clear focus on innovation and links to the science base within the East of England.

These courses are distinctive in that they are taught using a combination of leading researchers, academics and business leaders all of whom can bring their own particular expertise and experience to bear on the programme. This creates courses which are both drawing on the latest science and innovation at the same time as being very applied.

Case study 6 – InCrops is collaborating with Tamil Nadu Agricultural University in India to reform the manufacture of fertilisers in the UK

Tamil Nadu Agricultural University (TNAU) is a leading agro-technology provider in India and its graduates are recognized throughout the world. Although Tamil Nadu Agricultural University was only established in 1971, it has its genesis in the establishment of an Agricultural School at Saidapet, Chennai, Tamil Nadu, India as early as 1868. InCrops and TNAU exchanged visits in 2010, and have devised a working collaboration on the use of

biochar and biofertilisers, both areas of increasing interest in the UK as farming addresses the challenges of producing more whilst impacting less.

Professor Santhanakrishnan visited InCrops in September 2010. He is a Professor of Microbiology at TNAU with 34 years of experience in soil microbiology, biofuels and food microbiology and has worked on Arbuscular mycorrhizal fungi for 25 years. In India Professor Santhanakrishnan has developed a combination of nitrogen fixing and phosphorus solubilizing microorganisms which can increase the yield of horticultural crops whilst also reducing the use of inorganic fertilizer. Professor Santhanakrishnan is now working with InCrops on the evaluation and development of biofertilisers and biochar as new sustainable agricultural inputs for the UK.

September 2010

Oral evidence, 3 November 2010, Q 1–37

Evidence Session No.1. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witnesses

Witnesses: **Dr John French**, [Director of InCrops Enterprise Hub, University of East Anglia], and **Ms Marie Francis OBE**, [Chair of InCrops Limited, University of East Anglia].

The Chairman: Good morning. Thank you very much for attending. We're looking forward to your evidence. I'll just go through the formalities, if I may, and then we'll come to a couple of points. First of all, in front of you, you have a list of interests that have been declared by Committee members, and I'll just go round the table and ask Committee members if they can state any interests that are relevant to this inquiry. Perhaps I could start by saying I'm a farmer.

Lord Cameron of Dillington: I'll go next. I'm a farmer and trustee of Rothamsted and have various ancillary agricultural interests.

Lord Giddens: I'm totally disinterested and neutral.

The Earl of Arran: I'm married to a Devon farmer.

Baroness Sharp of Guildford: I'm a visiting fellow at the Science Policy Research Unit at the University of Sussex.

Lord Lewis of Newnham: I'm by nature a chemist but interested in waste problems normally associated with some parts of agriculture.

Baroness Howarth of Breckland: And I do a variety of things but I don't think I have anything to declare in relation to this particular inquiry.

The Earl of Caithness: I'm a trustee of trusts that have got agricultural land.

Q1 The Chairman: Thank you. This is a formal evidence-taking session of the Sub-Committee and full shorthand notes are being taken. They will be put in the public record in printed form and on the parliamentary website. We'll send you a copy of the transcript and you'll be able to revise that for minor errors. The session is on the record and is being webcast live and will be accessible on the parliamentary website. For the record, it would be helpful if each of you could begin by stating your name and official title, and if we could ask you then in your opening remarks as well just to talk about your relationship with the University of East Anglia, because we'd like to be somewhat clearer on that.

Ms Francis: Marie Francis, I'm chair of InCrops.

Dr French: I'm John French. I am Managing Director of the InCrops Limited InCrops Enterprise Hub, and employed by University of East Anglia as the responsible manager for the Enterprise Hub.

Ms Francis: Our submission was based on the principle that we're interested in science for business rather than science for scientists. So, first, a bit of background. InCrops, which stands for Innovative Crops, was set up as part of a strategy for the east of England. So it was backed with funding from the East of England Development Agency and the European Rural Development Fund. Once it was set up it was clear it needed to have a proper home to ensure its long-term development, and we linked up with the University of East Anglia. So it's now a wholly owned company, owned by the University of East Anglia, and it fits in with the whole Low Carbon Innovation Centre and the low carbon agenda of the University.

The way it works, which is relevant, is that InCrops has 13 partners and the partners are most of the major research organisations that you will know about; so Rothamsted, John Innes, Food Research Institute, NIAB. It also includes some other organisations you might not necessarily expect: Cambridge University and the Building Research Establishment. They work together particularly for developing three things: new products, new businesses and new supply chains that are based on the use of crops. So it's crops for innovative uses and it's primarily in the non-food areas, but also in the innovative food sector.

Fundamental to everything that InCrops does is exploitation of research for commercial gain. It's business orientated and it's a mechanism that could be replicated across the whole of the food and research areas, although we're specifically working much more in the non-food areas. We work by supporting businesses and their commercial development of research.

The model is that we have business innovation managers, who are research scientists based in the major research organisations that I have mentioned. They get to know the science, but their results are measured in their ability to give support to businesses, looking at new businesses, new products, new supply chains. So there's a very close linkage between research, the SMEs, small businesses, bringing in corporate larger players when necessary, bringing in venture capitalists, providing business support and research advice. So it's grouping all these things together.

Anything else you want to say as an introduction, John?

Dr French: I think it's worth stressing that this is quite a radical departure from how things are normally done in this kind of sector. The project was first conceived of in around about 2005, and it took us through until 2008 to develop and plan this and then introduce it. The

Enterprise Hub has been operating since then, throughout most of late 2008 and through 2009, so we're just over two years into our operation, and we're now starting to see significant results from the approach we take in terms of this interface, if you like, between business and the research and development base.

Q2 Lord Giddens: Let me add my welcome to that of the Chairman and congratulate you on the quality of the submission and the success, or apparent success, of InCrops. You say that EU agriculture must embrace innovation. Could you say a bit more about what the prime driving forces of innovation in EU agriculture are? Could you also talk about both sides of the equation because innovation generates jobs, for example, but it also destroys jobs? All innovation has a destructive as well as a creative side, so it would be interesting to hear your thoughts on both sides of those issues, and especially specify where you think the main driving forces are coming from or should come from.

Ms Francis: Before I tackle drivers, can I just ask you a question? Have you had any other submissions? Because there are certain things that if you had other submissions you will have heard again and again and again.

Lord Giddens: We've had other written submissions but this is the first part of the inquiry so, therefore, the answer is no.

Ms Francis: Right. The first one then is demand: increasing populations means more demand for food. So that's a strong driver. What does that mean for innovation? You have to pull out commodity crops. If there's more demand for commodity crops, a likely result is that prices go up. If prices go up, surprisingly, you don't necessarily get more innovation; you can get less innovation because your traditional systems still become productive and profitable. So the need to change goes down. An example in this country: a couple of years ago grain prices rose and in our region small farms looking to diversify suddenly realised, "Actually, we can make enough money doing what we've always done and we're happier doing this, so we don't need to be developing other businesses".

So increased demand for commodities, for food globally, can reduce innovation, but increased demand or new demand for new products will drive innovation, particularly when you're looking at products that are based on low-carbon innovation and on moving away from an oil-based economy towards a biological-based economy. So, that's one driver.

The next one, which I think is possibly even more significant, is resource constraint. If you haven't got enough land, if you haven't got water, if you haven't got energy, or there are constraints on any of these, constraints on labour, then people innovate because they have to. If you can't get the workers to come in and harvest your crop, then you'll be looking at mechanical ways and automated systems that will remove the labour requirement.

If energy is constrained because it's expensive, or because it's not available, or because you need energy security, then you'll find ways of running your system more efficiently and looking for alternatives. So resource constraint can be a very significant driver. If you haven't got enough water, that's when you're going to be developing and putting into application genotypes that enable you to grow crops in more drought-prone situations. So, that's the second driver.

The third one is climate change and the need to reduce carbon emissions and lock up carbon. This brings me on to the whole big area of developing bio-renewable products. That

means, quite simply, replacing or displacing oil-based equivalents, and this is an area that can bring major benefits to the economy.

So, what do I mean? Let me be more specific. A lot of our economy is based on oil-based products. If you're extracting oil you don't just use oil for energy. You use the oil, it goes through an oil refinery, you produce energy, but you are also using all the other chemicals that you can derive from the oil for a range of different products.

We are moving into a situation where crops can be used not just for food, not just for biomass for energy, but where every part of the crop is used. Some will be used for energy, but you can then start to extract a range of different chemicals to build your paints, your solvents, your cosmetics, your plastic replacers. All these are possible and they are all low carbon. So the need for low carbon will drive innovation in a very significant way, particularly at the high-value end rather than the bulk commodity production.

Fourth driver, environmental concerns: always there is a demand for lower environmental impact products and processes.

The last driver I want to cover is Government policy, tax, regulation and grant aid because all these can either support or hinder innovation. One thing that's clear is that it's more difficult to get commercial finance and the need to be able to get loan funds for innovation. Linked to that is a need to be able to get funding for developments that are potentially high risk. If they're not high risk they're not very innovative. The problem is that a lot of support has gone in for innovations that are low risk, so you get incremental change, which is all good; you have a crop that will yield a little more. But the step changes, the major developments, require the need to fund things that are inherently going to be risky, and some will succeed and some won't.

It might be useful, John, do you want to speak about the Low Carbon Innovation Fund?

Dr French: Yes. One mechanism we think is very important is that small businesses can access investment funding to take some of their innovations forward. When I'm talking about small businesses I mean across the board here, not just agricultural businesses or farm businesses. This can be SMEs, firms in areas from bioplastics to new biomaterials, of which there are quite a few clients we are now working with.

In many instances, if these companies can access investment capital to take their innovations and developments to the next level, that can be a huge asset to them to take them forward. UEA ran the Carbon Connections programme over recent years and it now has the Low Carbon Innovation Fund. These are low-carbon venture capital funds, essentially, where businesses can apply for support. The investment that is made into the business is not only for financial reasons; it's also to produce beneficial low-carbon economic benefits. We've just opened the Low Carbon Innovation Fund for businesses to apply for, and we are now getting a good range of applications.

We are also in touch with a number of other venture capital funds, including a new Japanese agribusiness fund, and they are very interested in being able to tap into the supply of clients that InCrops has in the agribusiness sector so that we can help them to carry their innovations forward. The danger is otherwise you provide some initial support and guidance, but they can't actually take their ideas all the way through to fruition. So, that's one of many mechanisms that we use.

Q3 Lord Giddens: Can I just pursue one or two other things? I think the remarks you make about oil are interesting because over 90% of manufactured goods involve oil at some point in their production, so this is a thoroughly oil-based civilisation. Can you give an example of an innovation that is already working to displace oil in some fairly significant aspect of a production process, apart from biofuels?

Dr French: Most BMW Series 3 and Series 5 vehicles have hemp-fibre door panels, on the inside of their doors, so that's a good example of that. That is substituted for a polyurethane-based infill, so it has properties in terms of sound-deafening, crash performance, and it's an ecological product as opposed to a synthetic product.

Q4 Lord Giddens: Yes, very interesting. Just finally, I also asked about the downsides of innovation. Innovation obviously has a creative component but by definition it has a destructive one. Often agricultural innovation especially has decimated jobs, for example, undermined communities and so forth. Do you study those aspects of innovation?

Ms Francis: The biggest problem that has held agriculture back is that it's been seen as a mature industry that isn't going anywhere, that is a sort of muddy boots industry; it's not been well portrayed. So it's no coincidence that over the last five or 10 years the courses at most universities and agricultural colleges that have been successful have been the environmental ones because this has been seen to be the exciting growth area. The agricultural and production courses have really dropped away to very insignificant.

So the downside of innovation is, you could say, losing some low-calibre jobs. The upside is that you're building in much more high-calibre jobs, not just in production but in engineering, in the technology and the IT that's needed to manage it. Let me just give you an example. For instance, the pig industry is pretty innovative, generally larger scale, well-linked into supply chains, a lot of monitoring. A pig farmer I know with a large business has all the pig houses computerised, so you're monitoring every aspect from humidity to feed to growth rate to get optimal performance. Information is fed back to the central computer in the office. You have the farmer who has set it all up and is struggling to get the high-calibre people he needs to use this information at a high-level management way to get the benefit from the work that's been done.

So, innovation is going to change the jobs that are required. It will remove a lot of the low-grade jobs and increase the value of the jobs that are there, which must be a positive.

Could I add something else? You asked for an example and John gave you one: hemp-fibre panels from BMWs. One of the projects we're involved in, which is again cutting edge, is the use of algae. Now, algae can produce about 10 times the biomass of traditional crops. We're working again with a range of partners to set up an Algal Innovation Centre based near Cambridge to carry out practical studies on the use of different types of algae, the way you grow them, how you can extract products from them, because the potential is there for algae to be growing, for instance, on the waste water that comes out of anaerobic digesters. So you use a waste that is, in effect, a nutrient broth. You're growing your algae; you're converting it into everything from more biomass to produce energy, to particularly cosmetics, nutraceuticals, pharmaceuticals, individual chemicals that can be used as building blocks. This is all part of agriculture and innovation because it's using the energy from the sun. It's using a plant, which in this case is algae rather than traditional crops. But this is where we have to be going, and it is happening. You have large-scale algal farms in, I think, Spain and Portugal, where you have high levels of sunshine. What we're looking at for this

country won't be these great big algal farms for energy but specialist algal production for high-value products.

Lord Giddens: I think that's very interesting.

The Chairman: Baroness Howarth, do you want to ask something on the consumer in this?

Q5 Baroness Howarth of Breckland: I could ask it now. I was just interested in how you see the end-consumer as a driver. Because at the end of the day, your products have to be purchasable once they've been through the whole process of innovation and through to those who are going to deliver the products to whatever the consumer happens to be. I reckon there are a range of consumers here. How do you see that as a driver and where does it fit in the whole of your scheme of things?

Ms Francis: It's consumers that produce the demand that drive the whole process, so the products have to be meeting a need of the consumer and it will be everything from price to performance to availability.

Just going back, I would have no problem as a consumer choosing to use hemp that's been produced for loft insulation, which is a really nice, soft product and very effective, rather than going up into the loft and laying fibreglass, which is really unpleasant.

Q6 Baroness Howarth of Breckland: Can I just cut across that and ask you, if you believe that and if you look at the whole GM issue, what are the university and your organisation doing, to make sure that the public understand innovation and the value of it and then don't feel that they don't want to use the product? How are you enabling demand for these projects?

Dr French: There are several ways of dealing with this issue, but I'll give you an example of some of the things that we do. We run regular seminars and events on different sectors and areas of our work. That can range from anything from functional foods for health through to biolubricants, to using different industrial settings, through to opportunities for professionals in areas like architecture to adopt new types of product that have a better carbon footprint, if you like, or have come from a biorenewable source, and enable them to make their own assessments of the differences between these new materials and some of the existing materials. We tend to run these as open seminars where we get expert speakers to come in and talk about these topics and then we have a debate.

Those events have two effects: one, they raise the awareness and increase the public understanding of these issues; but the other effect it has, of course, is that it brings small businesses and entrepreneurs through the door who then become clients. And we give them free business support, which is funded using our European funding, which enables us then to carry forward these ideas with them. Does that give you an example? That tends to be how we address that.

Q7 Baroness Parminter: I am very interested to see if there are any common key components of successful innovation models. So I wondered if you could firstly, with

reference to the six case studies that you provided us and, indeed, other case studies, identify if there are any common key components. As a supplementary to that and following on from it, could you then talk through whether there are some case studies that perhaps were failures, where you have tried to commercialise products and it hasn't worked? Are there common reasons why those attempts have failed?

Dr French: If I start this off, the approach we've taken within InCrops is that we provide very flexible and tailor-made support and guidance to our businesses. That comes from a team of business innovation managers. So they all interact with businesses on a regular basis. They do a kind of diagnostic, if you like, with companies and they help them to assess what their innovation needs might be.

That leads to a timescale for delivery of that innovation, that new product or process. It also invariably leads to networks or partnerships emerging that enable that company to access the facilities or the expertise or the knowledge that it needs. These are relatively common characteristics.

The staff that we employ are all specialists with both business and science backgrounds, and they can also access other specialists that are needed. So we don't have people that are generalists providing the first point of contact; we have specialists. But our specialists vary in their skill sets. Some of them are specialists in bioenergy, some biocomposites, some are biopolymers, bioplastics, plastic packaging, areas like that, and other colleagues who are in areas like construction and the built environment. So there is quite an important distinction in terms of the different market drivers and the different demand requirements of many of these sub-sectors. Each of the team have their own distinctive portfolio in that respect.

All the case studies, at one point or another, have resulted from an individual or a business approaching us and asking us for assistance to develop a new area. In the case of the Algal Innovation Centre we have a whole group of customers, clients if you like, who want to do new innovative work in the algal sector. So there is a cluster built up around that, which has led to the concept of some infrastructure that can lead to and support the interests of businesses in the algal sector.

The same applies with hemp technology. Here we have not just them but several other companies in the fibre sector, and they are working in markets all over Europe and the world, but they have different needs ranging from fibre technology through to processing or to accessing markets even, and marketing.

So these are common threads that run through these things. If we take case study three, that was one of the first SMEs that we supported. It was very keen to exploit the opportunities associated with natural pesticides and natural biocides and, as you'll know, changes in the EU regulations have encouraged the move away from synthetic towards natural pesticides. That's an excellent opportunity. This company was very innovative. It had a range of potential natural nematicides it had available to develop, and through our facilitation we have brought together a partnership with that SME. We have some Technology Strategy Board (TSB) funding and we have the involvement of both the John Innes Centre and Syngenta as partners.

So you also have that rather nice combination, what I would describe as open innovation, where you have a large multinational involved, you have a research partner of some credibility with the expertise that you need, and you have an innovative SME drawing upon that capability to move forward into a new marketplace. From that you can see some of these characteristics emerging.

Case study four was a new start-up company that came to us. They wanted to develop new expanded foam-based building panels using materials other than synthetic polyurethane-based products. The technology and the knowledge resides with Fraunhofer in Germany, so to move that innovation forward we set up a collaboration agreement. We are now working collaboratively with Fraunhofer and this entrepreneur. He's expecting to enter the market next year with a range of new products using things like expanded foams from plant oils that have been extracted and polymerised.

So you can see there is a level of networking and collaboration in here, but there's also a large amount of facilitation and support going on to make sure that the businesses follow through and then take these ideas through to fruition.

The Tamil Nadu Agricultural University example is on the list to be discussed later, so I won't go into too much detail about that, but that comes from interest in alternatives to inorganic fertilisers and what possibilities are there in terms of the commercial opportunities around alternatives to inorganic fertilisers.

Clearly, strategically we would like to assist that development area because inorganic fertilisers have been held up in the Stern Report as one of the possible contributors towards greenhouse gas emissions from farmland and the whole contribution of industrialised agriculture. Clearly, if we can work with innovative small businesses around alternatives, that could help this whole general thrust of activity. Does that answer your question?

Q8 Baroness Parminter: Yes and no. It was very helpful in identifying how your business adds value and the role, as you've analysed it, with the networking of facilitation. I've taken that as a key component. But I wanted a bit of a broader sense. In your experience with those projects, were there any common factors every time you took forward a project? For example—and I am making them up because I don't know—if you didn't have the interface between an SME and funding at an early stage, did you know from the start it was going to collapse? Are there any sort of common drivers?

Dr French: Yes, common drivers involve good ideas. We are often devoid of good ideas and those good ideas come from various places. They come from the businesses, sometimes they come from the science base. We often lack people with an entrepreneurial attitude. One of the things we're tackling through this project is to get a bespoke entrepreneurship programme running so that we can populate some of the new business ideas we have with individuals who have an entrepreneurial flair who would like to pick up some of these science-based ideas and run with them. Because often you have the idea but you haven't got somebody who will take it and make a success of it. But then the others are really interventions around facilitation, networking, funding, that you put together around those key elements.

Q9 Baroness Sharp of Guildford: Do you go searching for these businesses or do they come to you?

Dr French: Both. We don't sit around and wait for people to come to us. We make a habit of going out and talking to companies and looking at what's on the horizon that could be possible opportunities for them.

Q10 Lord Lewis of Newnham: How do you choose those companies?

Dr French: Invariably, they are in our area. They are in clusters of companies that already exist in the population centres in the east of England, so we don't selectively choose companies, if you see what I mean. We just make companies aware of the fact that we exist and we have these services to offer. Some companies—I shall be careful how I say this—are quite resistant to innovation. That's why we run the kinds of events that I mentioned, to try and raise awareness of the possibilities around some new development areas. You can't make people do things if they don't want to, and some companies have a reliable, stable existence they don't want to change.

Ms Francis: Also what is important in this is that we were set up with European Rural Development funding. It enables us to provide 14 hours of business support per business that they don't have to pay for, and they then move on to a consultancy basis. But you have that one-to-one flexible input directly geared up to the interests of that business, and the ability to do that can make everything else happen afterwards.

There are a couple of other points, if I could just make them. Another thing that's clear is that a lot of the time the research has already been done. The information is out there but it's not getting through to the businesses. So you're not talking about the need always to be doing new research. Sometimes you need to initiate it. But a lot of the time it's there, you just need to get your hands on it and enable it to be commercialised.

The third one is coming back to why things fail. Well, if you could go through a checklist and say which are going to win and which weren't, that would be easy. The whole point is there are certain parameters, things you need that John went through, but once you have that, some of these ideas that seem quite good will fail. Others will succeed, and you don't know which they're going to be, and it's the whole difficulty of supporting businesses. It's where I began: you have to have acceptance of risk because you don't know and if you try and play it totally safe, then you'll miss the good ones as well as the bad ones.

Q11 Lord Lewis of Newnham: Could I just ask quickly, how far do you run into problems over management? I have seen in universities, for instance, some extremely good ideas, which in principle one anticipates will go forward, but the failure has come in the actual management application interface with industry and various other things.

Ms Francis: That is absolutely a major issue, higher-level management within the whole agricultural, food and biorenewables industry, because you need a level of management and the technology expertise to handle innovation that needs developing more and more. Again, one of the questions later on is about the Centre for Contemporary Agriculture, which has been set up at UEA. It is partly to do that, it's to deliver this high level of skills that are required, because all the good ideas and all the technology in the world won't work without the right people to manage it.

Q12 Baroness Sharp of Guildford: In your note you talk about the need for private investment in R&D to be encouraged, and from what you've been saying, it's quite clear that you used the core of European funding to leverage a whole lot more funding, partly public sector, partly private sector. How best do you think the private sector can be encouraged to invest in R&D?

Ms Francis: Well, I'd put it the other way round. If the private sector doesn't want to invest in a particular project, for instance our algal project, then nor should the public sector. It has to attract private sector funding and then you have the chance of having something of commercial value. If it doesn't, then you're probably wasting your time. So, it is how do you attract private sector? By having projects that interest them where they see there's potential pay-off and business opportunity.

Q13 Baroness Sharp of Guildford: Do you think there are any particular incentives that will encourage the private sector to put money in, or are you saying here that there shouldn't be incentives because the private sector has to show the initiative first?

Ms Francis: No, I think the public sector can show the initiative first. I think the pump-priming role is key. Do you want to add to that, John?

Dr French: There are different levels to this debate. With very small businesses they often cannot afford to do research and development and would probably prefer not to because they don't see it as their business to do that. In many instances they would be much happier if there was a small amount of assistance given to enable them to purchase R&D elsewhere, but then they can purchase the R&D that they need. They can define, they can specify, they can commission that near-market piece of research, which is what they particularly need.

There are various mechanisms to assist in that: innovation vouchers of quite small amounts of money, of about £3,000 each, which many of the RDAs operate as a scheme. That is a bit on the modest side, but it's amazing how much short, quick and relevant near-market work can be done with an innovation voucher, which they then trade in at a research partner. So, that's one mechanism.

I think we should be looking at the whole corporation tax environment for small businesses, to encourage them to take on board R&D or to give them some exemptions around the costs associated with R&D. In other countries that is done. In some countries, some small and medium-sized businesses have some very impressive R&D capabilities associated with certain sectors.

The third point, I think, is that what we want to try and avoid with some of the collaborative projects that we are helping to generate through our activity is projects that are purely public sector projects. Obviously there are always intellectual property issues when you have multiple partners in projects, and we have to be clear about that, but the likelihood of it becoming translated through successfully into some kind of economic impact is going to be greater if you have a public/private consortium than if you have just a public sector applied research project that then seeks to produce something relevant, which may or may not be picked up at the end. So we don't want to just do the work and hope that somebody will come along later and say, "That's useful". So I would advocate private sector or private sector/public sector partnerships to do this kind of work.

Q14 Lord Lewis of Newnham: You state in your submission, which I also compliment you on, at number four that, "The UK is a global leader in research for agriculture". Now, how do you contrast this with the situation here of trying to get the sort of development in public sector coming into it? A supplementary question, which I think touches on the point that you made, Ms Francis, is that, in fact, the entry to the agricultural world as a whole seemed to have gone down in some way. Are the people involved in this research, then,

very much institutes, universities, and are they people who are not trained essentially in agriculture but, say, in other branches of science that are being applied to agriculture?

Ms Francis: Where we're world class is the agriculture, it's not at the real production end. It's places like the John Innes Institute, Food Research Institute, Cambridge University, the plant biosciences. These are the research areas at the world-class level. If you come down to the basic crop development and crop production, then our research has dwindled over the years. And you go back to the increments in yields, cereal crops, oil-seed rape and so on, which was, I don't know, 2% a year every year, and they've all levelled out. That is a direct result of less near-market type of research going into crop production and crop production techniques. It's because the whole area of soil management, soil fundamental to growing anything, to locking up the energy from the sun, has fallen between the gaps where no particular research organisation has considered it was their responsibility. Because you've had specific crop-based or animal-based research, and the soil has just been not quite ignored but it's not been developed. It's why we've got locked into fertiliser, artificial fertiliser, that has been used at levels that are probably higher than were needed, to develop the same results from the crops. If you had moved to, for instance, precision technology, the information is out there. Every farm could be using precision application of inputs, but it's not happening because that technology hasn't been transferred into everyday use on enough farms. I think I've wandered off.

The Chairman: It probably leads us to the next question, I suspect.

Q15 Baroness Howarth of Breckland: I think you talked a little about the relationship between public funding and private funding. In your introduction you are really rather disparaging about the public sector. You say the public sector doesn't seem able to make any progress, and yet if you look at the nature of your funding, which I don't have in detail but what I have heard and what I have read from your documentation, you are a great mix of the two. Without the public funding you would not be able to function in relation to bringing in your private funding.

Now, there are implications in the present budgetary situation and we wondered whether you had some thoughts about how you were going to face any reductions in public funding, which will have an effect on your budget, and whether you think there is any added value from the EU research funding and whether you can tap more into that.

Dr French: If I start off, and then you can carry on, Marie. We are very grateful for the public sector funding that InCrops has from both the Regional Development Agency and from Europe. We could not have delivered InCrops without that funding. That's absolutely clear.

But if you look at the genesis and why we are putting crops in place, it was because we did an initial study back in 2006 where we identified that quite a fundamental gap had opened up between the high quality research that we conduct from many of our top quality centres in the UK, and the needs of SMEs, businesses, growers and farmers at a practical level. So we identified that gap, and that was a product of a systematic review. As a result we've put in place the InCrops structure. It wasn't called InCrops at the time, but it became InCrops later.

Now, going forward, we see ongoing access to European funding, either structural funding or research funding, as absolutely critical. At the moment we tend not to draw down and

spend all of the allocations we have for European funding in the regions in this country. Whether that's through the regional development programme or through the European Regional Development Fund, the uptake and expenditure is behind the targets. So I think as a strategic priority we should be looking to what we do to facilitate more effective drawdown of those funds into innovation-related projects that benefit the rural sector. So, that would be my first main answer.

The second point is I think going forward, in terms of budgetary dilemmas, we do need to work with more private sector funding into research than we have presently seen. There is too much dependence upon the public sector for many of our strategic research projects. It would do no harm at all to have a broader platform of funding for some of that work.

Q16 Lord Cameron of Dillington: What percentage of your funding is private sector?

Dr French: For InCrops itself or for our partners?

Lord Cameron of Dillington: Well, altogether, for both your core funding and including the projects that you have given us, for example, as an average?

Dr French: The current InCrops project is 90% public sector funding coming through, and that was deliberate. It was set up as an intervention because the language you use in public sector projects of this kind is you identify that there's a market failure, and then the funding available from the RDA and from the European Union is used to assist in an area where a market failure has been identified. The market failure we identified was the relationship between the research base and the need of SMEs, so we're in that space but—

Q17 Lord Cameron of Dillington: If the public sector funding was reduced could you get more from the private sector?

Dr French: For InCrops itself, we have a sustainability business plan, which assumes year on year an increase in private sector work over a period of five years from inception. We are now seeing increasing numbers of private sector projects coming into InCrops. But that was part of our intention. We didn't intend to run InCrops beyond a certain period entirely on public sector support. We saw that as the initial kick-start to allow us to function.

Q18 Baroness Sharp of Guildford: Am I right in thinking that to unlock European structural funds here, you need to get matching funding from a UK agency, and it has largely come from the RDA? Are you going to be hit by the abolition of RDAs?

Dr French: Yes, in a word. The European Regional Development Funds exist for all the regions. We have many regions operating these funds separately. Up until earlier this year they would normally expect to be able to access matched funding from RDAs; that has been stopped. It is bound to have a detrimental effect on the drawdown of European funding.

Q19 Lord Lewis of Newnham: We carried out a previous inquiry into the adaptation of agriculture and forestry to climate change. One of the things that came through to us was

that the actual transfer of knowledge to the practitioners was a major weakness in discussing the whole concept of agricultural innovation. You mention in your documentation that you're setting up this CCA, I believe, which has been established to develop an active programme of knowledge transfer. We were just wondering if you could explain a little bit more to us about the CCA and, perhaps, what lessons could be learnt from the experience, and particularly in overcoming problems over transfer of knowledge.

You referred earlier, I think, to the fact that the agricultural profession in this country was getting older, and we've been told that the average age is about 58. There is no doubt at all about it, the older you become the less sensitive you are to innovation in techniques, whereas I think if you take the position in Europe as a whole, there have been schemes suggested by the EU. For instance, in France I believe they have mechanisms of encouraging young farmers, with grants and things of this nature, which I do not believe happens in this country as a whole. I wonder if you could comment on this particular area as a whole.

Ms Francis: I'll just comment on that and then John can explain about the Centre. A lot of attention is given to the age profile. I don't think that is as important because there's often younger people involved in the businesses; it's not their name appearing at the top of the list. I think if you really want to move this industry forward, and what we're trying to do, it is an exciting, high-tech industry that requires people at a high level with a whole range of skills. Because where agriculture is going, in production farming, the whole area of engineering, of refrigeration, of development of supply chain, supply chain management, transport, all these areas are all inter-related, and this is all part of the sustainable agricultural and food industry that we need to be developing. This is where knowledge transfer needs to be occurring, between all these skills.

What we're trying to set up, a Centre for Contemporary Agriculture at the University of East Anglia, is to take a much wider look at the whole food and farming industry and the skills that are required and how they all inter-relate. John's been very closely involved with this.

Dr French: Yes. In brief, as you know, agricultural training in the land-based sector has been very focused on specific needs, specific skills, and many of our major research institutes haven't been involved in training associated with the land-based sector. So the thinking behind CCA was quite simply we would put in place a new capability to train undergraduate and postgraduate students that would draw upon an understanding of the needs in the future of sustainable agriculture, and to use inputs from John Innes Centre, from NIAB-TAG and others, into the curriculum, as well as industrial contributions and business contributions into the curriculum, so we produce a new cohort of leaders, if you like, capable individuals that can go in and help to change the face of agriculture in the environmental, business and global context that we now live in.

So it is quite a new departure. It's a new centre of UEA. It's been set up in collaboration with Easton College, which is an agricultural college, and it has a new curriculum currently under development and is about to start to deliver the MSc in Sustainable Agriculture as its first course.

Q20 Lord Lewis of Newnham: Can I just ask a supplementary to that? We were told in our previous investigation that the number of educational institutions involved in agriculture has dropped. You mentioned earlier something about Cambridge. I was in Cambridge when there was a Department of Agriculture and that was thrown aside. I won't go into the

reasons why, but it was. Now, it does seem to me that in some way or other are you trying to reinstitute a credibility for agriculture as a university course as opposed to application of other people's scientific abilities into agriculture.

Ms Francis: The starting point for the Centre for Contemporary Agriculture is that businesses and what they require is at the heart of it, and it's bringing together three strands: the academic expertise; the research expertise; and the businesses' requirement. It's linking all those together so you get beyond just teaching students about how to grow a crop, the very traditional agriculture. It's taking it much wider, so there's much more interaction.

I would say it is trying to liberate food and farming from its past, from having become a subject that the youngsters aren't wanting to study to one that is tackling the big issues facing the world: how to feed the population, how to address global warming, how to meet biodiversity needs, how to do all these things together, and to do it profitably and commercially and to use the research and to compete with the problems of shortage of water. All this is really exciting, and it should be generating interest from the up and coming generation. That's what we're trying to do here.

Q21 Baroness Sharp of Guildford: Are these postgraduate courses that you are running?

Ms Francis: Both.

Baroness Sharp of Guildford: Both undergraduate and postgraduate. Are they all short courses or are they traditional three-year undergraduate degrees?

Dr French: At the moment it's undergraduate degrees and postgraduate courses with the intention of introducing short courses as well, based on those.

Q22 The Earl of Caithness: Given that you have said that if farmers make any profits the first thing they stop doing is innovating because they can go back to their traditional ways—

Ms Francis: In some situations.

The Earl of Caithness: You then said the industry is going nowhere. You then said precision technology is out there for the farmers, but if they're not going to spend any money that they've made—and for years they haven't been making money, particularly the smaller farms in the north—isn't your CCA not anything new but a reinvented mini ADAS to try and help the farmers cover the areas that were helped by public sector when I was helping farmers in the early 1970s?

Dr French: It's nothing like ADAS. The Centre for Contemporary Agriculture started off as being called a School of Sustainable Agriculture. We decided that sounded too academic and it should be more focused at business and industries, so it became the Centre for Contemporary Agriculture. Contemporary, because we're looking at new solutions and trying to have a forward proactive look here at what needs to be addressed in order to deal with the issues around sustainable food and farming.

Now, I would say that in the UK we have not always seen the most impact from land-based colleges that we might have seen in terms of benefits to the sector of agriculture. Some of that is due not to the institutions themselves, but to the changing perception of agriculture. Young people don't see agriculture as something they want to go into.

Somehow we need to excite the next generation so that in their minds there's a direct connection between climate change and sustainability and the work that they do in their careers as farmers, growers, processors or managers in a sustainable community.

So we are trying to completely reshape the whole approach to how some of this curriculum and training is delivered through this new, rather experimental Centre for Contemporary Agriculture. I would stress it is a new centre; it has only just been launched. It has come out of many of the business contacts that InCrops has but is a relatively new development. We would be very happy for anybody to provide influence or contributions to the future direction of that new Centre, should you wish to.

Q23 Lord Cameron of Dillington: Thank you very much. Obviously, this inquiry culminates in a report that is addressed to Governments, both at the national level and the EU level, so we're interested in trying to help and advise Governments on how they can take this agenda forward better.

How would you advise Governments at all levels, local, regional, if that's going, national, European, to assist in better innovation in agriculture? And are they integrating enough? Is there enough integration across the field or even between member states as well? And where does the CAP fit into all of this?

Ms Francis: I'll start. I think one thing you can do, which doesn't cost a lot of money, is ensure that a low carbon agenda is a policy priority. I say that because once you start looking at every aspect of agricultural production and land use, if you're being driven by the need for low carbon you will get a lot of the other benefits that you want in terms of innovation, greater efficiency, better use of energy, more competitiveness, and higher yields. They all come together under this one policy. So I would really like to see that as central because it will lead to the innovation in all areas not just of production but through the whole supply chain, and spin off, give economic growth as well and put it in a strong position in terms of our industry, in terms of the rest of the world. Because you're driving green technologies; you're also developing the green technologies that have economic benefits.

Before you get to CAP, free trade open markets are fundamental because if you mess around with the markets then you'll have more of an effect on the production systems, not necessarily the way that you want to go. CAP shouldn't discriminate against change and what's new in development, because if it does, if it's always trying to push the industry back into small scale, small farms, local, all these have a place. Don't quote me saying we should get rid of all that, but the majority of your food production is coming from 95% of land that isn't being used in that way. It's keeping a CAP support that enables the industry to develop and change, albeit meeting the requirements of safety and environment. So that requires a degree of flexibility.

I've mentioned open and free markets because they encourage competitiveness. It's also important, at a European level in particular, if innovation in agriculture is not kept in a silo but is linked to innovation in other areas, particularly in engineering and in manufacturing and transport. There are all these other areas of innovation that are just as relevant for agriculture as what is called agricultural innovation.

Q24 Lord Cameron of Dillington: So do we need more trans-European integration of the innovation programme?

Ms Francis: Yes, we do. There's quite a bit we can talk about at trans-Europe and trans-national level.

Dr French: I was speaking a few weeks ago at the Conference of Cities and Regions in Brussels. I spoke from the UK, but we had speakers from all over Europe. The theme was the impact of green technology on employment in rural areas, and it was very clear to me that many countries in the EU are tackling these subjects in isolation from one another. We're all coming up with similar but slightly different solutions, and we're not spending enough time studying the approaches that the other countries are taking.

There was a lot of interest in what we were doing but, equally, I saw some extremely good practice in other countries as well, and we've suggested that we have a more formalised link-up around some of this technology transfer and technology translation work across a number of European states where it will benefit the rural economy.

Now, there are some good examples at European level of technology transfer networks and Technology Innovation Centre initiatives, and you hear a lot of discussion of Fraunhofer as a model. That's in technology, not just green technology but technology across the board. There's also quite an enthusiasm at the moment in the UK to adopt a similar model. I would argue that we should be looking at a model that we can adopt across a European platform to maximise the capability that we have in a number of different European countries.

The other point I would make is that innovation isn't always around inventing new ideas or creating new products or processes. Sometimes it's about technology adoption. We often don't need to go and invent it again or come up with yet another variation of something we've already invented. Many of our most successful companies in this country—British Sugar included and I'm sure they wouldn't mind me saying this—adopt other people's technologies and implement them. I would argue that we need to get better at doing that and we need to be horizon-scanning across some of the innovations that are coming out of many of our partners in Europe, and then looking at how we best exploit some of those opportunities.

That is the basis for our relationship with Fraunhofer. They have technology we would like to adopt with companies in the UK, and that's why we did that. But there's much more out there and we're just scratching the surface. We don't have any co-ordinated or organised way of using our European funding to enable us to do that kind of leverage, if you like, and allow us to get technology adoption.

Q25 The Earl of Caithness: Your last sentence was actually crucial: there's no co-ordinating model at the moment. What should the co-ordinating model be? Should it be taken over by the EU in Brussels, or should we leave it to you in the private sector, partly publicly funded, but bash your heads together and get you to do more exchange?

Dr French: Top-down policy-driven work from Brussels isn't necessarily well accepted on the ground, or doesn't always lead to it being adopted. I think you need something between these two models you just offered up. You just asked a question; I would need to go and reflect on that in terms of what would be the best mechanism, but I think in terms of—

Q26 The Earl of Caithness: Could you reflect and come back to us?

Dr French: I'm very happy in principle. I think I would also like to take opinions from people on that, too, because we do have access to quite a lot of European funding and it isn't always deployed in the most effective way. So I think if we can take that answer away from today and come back to you with an answer, we'll do that.

The Chairman: Excellent. We would be grateful.

Q27 Lord Lewis of Newnham: Could you couple that also with the fact that we were given as a submission from the European Commission a whole list of various suggestions for setting up various types of organisations in this country, as in all European countries? I'd like to know how you review the success of those particular suggestions.

Dr French: We could do that. If you would like to share the information after the meeting we could do that.

The Chairman: If you can come back to us, that would be excellent, thank you.

Q28 The Earl of Arran: Just before we get on to Fraunhofer, you're probably aware of the 30,000 dairy cow units that are being operated in the United States of America. Would you regard those as agricultural innovation?

Dr French: If you ask me for an opinion, probably not.

Q29 The Earl of Arran: Why not?

Dr French: In terms of what the scale of the production is?

The Earl of Arran: Yes.

Dr French: Well, there are certain issues around the way in which the cattle are handled and the feed stocks—

The Earl of Arran: Animal welfare.

Dr French: Animal welfare, and there are issues around the impact associated with the feed stocks that are used as well. So this isn't a thought-through answer, but there must be ways of improving the nature of the animal husbandry and the agricultural productivity from that system, I would have thought.

Q30 The Earl of Arran: That would certainly be unacceptable in the EU at the moment anyway. On to Fraunhofer. Why Fraunhofer as against other institutions? What's in it for the UK and the EU?

Dr French: Well, it's pure serendipity that we happened to be working with Fraunhofer because we had a relationship with a business that had a need to access intellectual property that Fraunhofer holds, and that is the key to this particular story, in effect.

Fraunhofer is very good at producing innovations that it then patents and then licenses to companies to exploit. If you look at the Hermann Hauser report, which he produced earlier this year for Lord Mandelson, he analysed a range of different structures across the world and looked at the comparative performance of different technology and innovation structures to see how well they performed. Fraunhofer came out as a very high-output, high-performance structure.

Fraunhofer is a very large organisation. It has 62 centres across Germany. We're currently working with one and possibly two of these, and we're looking to formalise it into a more consolidated relationship. But they work in specific sectors. It's technology-driven and it comes up with outcomes that can be exploited and used in industry. There is an intellectual property model that sits behind that.

We are not quite as systematic about that in terms of our approach to exploitation of technology in the UK as Germany has been with Fraunhofer, and I think that's why it's an attractive model to look at.

Q31 The Earl of Arran: Are there other similar models, perhaps?

Dr French: There's a similar model in South Korea, which has mostly been led by the work in the IT sector, and there's another similar model in Denmark. All of those are documented in Hermann Hauser's report. He has taken it from the perspective of what the UK can do better in terms of our ability to translate technology into businesses. I think, in this context, we should be looking for a structure that is not dissimilar to Fraunhofer that might operate across Europe, which enables us to get best practice extracted from different European countries' institutes.

We have Wageningen in Holland. We're not formally into any kind of relationship with Wageningen. They have huge amounts of expertise and knowledge that could be usefully deployed in the UK, and so on. So I think we should have a fresh look at what the structure might be that would do that. I do like the Fraunhofer model, but I'm not saying it's necessarily the right one to just automatically duplicate in the UK.

Q32 Lord Lewis of Newnham: Can we, though, face the fact that Fraunhofer, like the Max Planck, is an alternative way of looking at higher education, as it were? They've been separated. The universities, as a whole, in Germany and the further east you go are less important than the research institutes that have been set up, so it's just a totally different model of approach to how you're going to do it. So, although I'm completely sympathetic with the interaction with them, I think the realistic prospect of bringing them into this country isn't very great because of the very nature. It would involve a complete step change in the way, I think, the system—

Dr French: I wasn't advocating that we bring them into this country. In a sense, I was reflecting on the fact that Hermann Hauser in his report advocates that we look at the Fraunhofer model and take some of the best aspects of it and use that to steer the approach we take to technology and innovation centres in the UK.

My thesis here is that we shouldn't be doing this country by country. That's my central argument. We should be looking and doing something that is trans-national and getting the best of these different institutes from these different countries to work collaboratively.

Q33 Baroness Sharp of Guildford: Do we have anything to learn from the French?

Dr French: The French have been doing some extremely interesting work on alternative and non-food crops in the Ardennes area, and they are extremely advanced in the work they're doing with fibre crops, especially hemp and flax. We have some very positive and good collaborative relationships in France.

Q34 Baroness Sharp of Guildford: In terms of technology transfer to small or medium-sized businesses and farms—

Dr French: We're not directly involved in that. Several of our businesses, though, do operate in France and export into France.

Q35 The Chairman: If we may just come to the last question, Dr French, you mentioned your work in Tamil Nadu. Perhaps you could tell us a little bit more about that and how the partnership works.

Dr French: It's a very simple, practical relationship that we have with Tamil Nadu. Tamil Nadu regard themselves as the leading agricultural university in India. It's based in south India in Coimbatore. Our relationship is about understanding their approach to using micro-organisms to supplement the soil and to increase soil fertility. This is not a concept that has been well developed in western science or western agriculture. We have been involved in some development work not just in InCrops, in UEA, in the Environmental Sciences School and also in the Low Carbon Innovation Centre, on the use of what we call biochar. This is a waste product from a gasification plant from biomass after it's been gasified. We've been looking and evaluating what the potential uses might be for biochar.

By coincidence, I was in India visiting Tamil Nadu Agricultural University earlier last year and discovered they use lignite, which is a mined fossilised peat-type substance. They use it as a carrier for micro-organisms, which they then add to the soil to supplement the soil fertility. They get quite high yields from their crops. They displace the requirements for inorganic fertiliser by 30%. In some instances in horticultural crops they don't use inorganic fertilisers. It seemed to me that we should investigate their approach by working with them with a completely open mind to what the outcome of that might be.

Tamil Nadu is extremely practical. It's a university but it is entirely driven by the needs of farmers, growers and the community. That is what they see as their priority, so they take a very strategic approach to ensuring that their communities can continue to survive off the land. So they have a very strong mission around that. That's the quality that I admire greatly and, of course, it means that they are very focused about the priorities that they work on.

So this project is under way at the moment. We currently have biochar being experimentally tested in India to see how it compares with the lignite that they presently use. In 18 months' time we should be able to report back on that.

Q36 Lord Lewis of Newnham: But isn't Rothamsted also looking at the whole effect of biochar?

Dr French: Yes. We have a biochar strategy group. Rothamsted is a very important partner and doing a lot of the scientific work in the biochar sphere. We don't claim to be, in InCrops, researchers in this area. We are doing the technology translation associated with this.

Q37 Lord Lewis of Newnham: Referring back to a point that I think Ms Francis was making about our lack of knowledge of the soil, I'm afraid this Committee is going to get fed up with me saying this, but I think it is one of the big lacunas in our situation.

Dr French: We have identified there's a real need to enhance the work we do on soils in the UK.

The Chairman: Thank you very much. I think, on behalf of the Committee, we would like to compliment you on both the written and verbal presentation. It was most informative, and thank you very much. We look forward to hearing from you on those outstanding questions.

Dr French: I think we're going to have to come back again.

Supplementary written evidence (IEUA 33)

Dr John French, Director of InCrops Enterprise Hub and Marie Francis OBE, Chair, InCrops Ltd, Board gave evidence to the Committee on 3rd November 2010

Committee request

The Committee requested further input on the following question:

‘What model, or arrangements, should be adopted to ensure effective pooling of knowledge about innovation in agriculture across the EU, taking account of the framework provided by the CAP in its present form (and prospectively in its form post-2013).?’

It was agreed that:

- a) a brief response by John French and Marie Francis would be submitted to the committee by 19 November, including reactions to the European Commission (IEUA 29) Memorandum.
- b) In discussion with Paul Bristow that InCrops would also provide a more comprehensive and strategic response to the Committees request. This would be delivered in January (date to be confirmed with the Committee) and would incorporate the views of the 13 InCrops partners³ with particular emphasis on potential transnational mechanisms for pooling innovation and technology transfer knowledge across the EU.

Reflections on European Commission (IEUA 29) Memorandum

I. Modernisation v Innovation

Innovation should not be confused with technology adoption. There are two issues, modernisation and innovation, they are not the same and cannot be treated in the same way.

- Under obstacles to innovation, (P.53,) and future challenges (p.55) reference is made to the ‘innovation gap’ between the most and least advanced farms and the need to transfer new skills and techniques to farmers. This is perhaps more accurately described as modernisation or technology adoption, not innovation.
- The purpose is to increase the number of farmers using tried and tested technology and implementing better management systems. This is different to farmers being innovative in their approach to and methods of production.

Innovation, as defined by the EU (P49) is turning ‘innovative ideas into competitive products and services.’ If modernisation and innovation are conflated then the models or arrangements for supporting them will be inappropriate.

It is essential that solutions to encourage innovation are handled separately to those that will support technology adoption.

³ The InCrops partnership includes: Institute of Food Research (IFR), John Innes Centre (JIC), Norwich Research Park, Rothamsted Research, Buildings Research Establishment (BRE), National Institute of Agricultural Botany (NIAB), University of Essex, University of Cambridge Department of Plant Sciences, Renewables East, Easton College, Forestry Commission, University of East Anglia (UEA) School of Biological Sciences and the Low Carbon Innovation Centre at the UEA.

2. Stages of Innovation

The emphasis on innovation as a socio-economic, rather than technological process (p.50) needs breaking down. There are stages of innovation from initial ideas, their conversion into products and services to the creation of new markets for the new products - only when the last stage has been reached is dissemination and uptake of innovation appropriate.

In many instances, SME's are unable to innovate directly and are better able to respond to new opportunities through:

- The adoption of technologies via licensing arrangements
- Open innovation partnerships between multinational companies and research centres.
- Collaborative ventures enabling many SMEs to be part of innovative new supply chains.

This can result in the adoption of new processes and new products across a broad spectrum of market sectors in the developing bio-economy. These in turn drive demand, adding value to agricultural supply chains and to primary producers.

3. Innovation today (p51)

The policy context in which innovation is occurring is outlined and the cross-cutting nature of agriculture is discussed but no mention is made of the influence of energy and policies affecting energy. In particular, the shortage of oil, cost of oil, effect on fertiliser availability and cost and, linked to this, the CO₂ implications of an oil-based economy - both in terms of production and in the use and manufacture of oil based goods. Policies that encourage movement towards a plant based economy, i.e. one where more energy and goods are derived from plants and where the use of oil in production is reduced, is a major driver for innovation within agriculture and needs to be considered.

4. Demographic structure of the sector (p.54)

Innovation uptake can be greatly enhanced by co-operation, both along the supply chain and across primary producers. It is only when sufficient scale is reached through many businesses working together that the risks inherent in innovation can be taken.

5. Knowledge and innovation systems (p.55)

The information flows that lead to innovation are complex and involve a range of disciplines and types of business – building networks that cross these different interests are essential for the development of innovation and its translation into new products and services.

6. Research and development (p55)

The need for a cross-cutting relationship between a range of FP7 programmes is fundamental to EU support for innovation in agriculture.

FP7 programmes with SME involvement operate across transnational boundaries, as do Interreg programmes. These make a significant contribution to the rate of uptake of innovation in agriculture.

But an opportunity is being lost. There is scope to enhance SME involvement in FP8 programmes so that many more businesses are linked to the programme and in ways

that ensure they are significant partners. This would result in higher levels of best practice dissemination across the thematic areas of the bio-economy.

Another area of funding, the European Rural Development Fund projects, enable infrastructure funding. But they are regionally based, and this limits both the number and type of business beneficiaries. It also limits the opportunity to develop transnational business support and linkages.

The ERDF funded InCrops project has demonstrated that an innovation network which places the business client at the centre of the process can lead to:

- the adoption of new processes and products
- supply chain integration
- leverage of the research base to support SME needs

Such an arrangement can:

- acquire, commission and translate knowledge to support innovation for individual businesses and groups of businesses
- enable business to respond to global markets
- utilise the outputs from both the pure 'elite' and the applied research base

It has also demonstrated that a spatially distributed and technically differentiated model for enterprise hub operation is workable and scaleable. In some instances it can lead to a refocusing of research priorities around business needs. It has resulted in quick win collaborations and trade links with BRIC countries and exposure of western researchers to different research paradigms.

Exploitation platforms can be used to drive supply chain integration in specific sectors of the bioeconomy, such as bioenergy or biocomposites.

They can utilise the knowledge base of multiple R&D centres. These can work in partnership with business to achieve critical mass and they can work across regions and states.

Critically, this model allows scope for differentiation in expertise between major centres rather than duplication. It represents a powerful low carbon economic development tool.

InCrops Observations

InCrops observations are based on the close working it has with both researchers and businesses to increase the development of new products, companies and supply chains in the low carbon, bio-renewable areas.

- 1. Individual nations invest heavily in their own research base** and then collaborate or cooperate at European level through programmes designed to promote cohesion

Conclusion: Integration is often minimal.

- 2. The needs of modern businesses accessing global markets are generally not met by linear technology transfer structures.** Instead, the national research base and its outputs act as the primary driver, this then leads to further enquiry and accessing of secondary research, only then is the route to innovation established.

The type of structures to enable this to happen are abundant in the nation states of the EU. But:

- there is often duplicate activity between centres, both within and between states
- dissemination is often channelled within and not between states
- A recent report by Hauser⁴ reviewed international best practice in Technology Innovation and highlighted models for consideration by the UK Government, proposing TICs⁵ with reference to the successful German Fraunhofer Institute.

3. The EU Commission should ensure that its policy and funding instruments discourage nation states from cloning structures on a state by state basis.

Duplication results in poor value for money and can hold back innovation by limiting transnational cooperation and exchange of information and research.

4. The need is for a more strongly collaborative partnership of leading centres across the EU and from all states. This could be brought together to:

- underpin a new transnational innovation and technology transfer platform
- focussed on green technology
- targeting SMEs and rural businesses

Such a model of development centres would:

- enable businesses to exploit the best of European research
- would stimulate the sharing of best practice
- drive the effective deployment of technology translation

The network of centres could also become a driver for appropriate and market tested innovations to support the CAP and its objectives.

Conclusion

There is a strong case to develop a new transnational innovation and technology transfer cluster to drive green technology development and stimulate businesses within the European agricultural economy.

InCrops will proactively engage in policy development and assist in scoping and developing ideas that would assist the development of any future transnational programme.

⁴ The Current and Future Role of Technology and Innovation. Centres in the UK. A **Report** by Dr. Hermann **Hauser**. For Lord Mandelson. Secretary of State for Business and Skills 2010

⁵ Technology Innovation Centres

Agriculture and Horticulture Development Board (AHDB)⁶ and the John Innes Centre

Written evidence from AHDB (IEUA 2)

1. AHDB is pleased to have been given the opportunity to respond to the Sub-Committee's call for evidence relating to its inquiry into Innovation in EU Agriculture. This is a subject of keen interest to AHDB and its stakeholders.
2. AHDB is an independent, evidence-based organisation with the mission to improve the efficiency and productivity of the UK agriculture and horticulture industries. It does this by providing cost-effective and relevant services to support the long-term sustainability of the different sectors for which it has responsibility. The innovation agenda is central to the AHDB mission as is providing a "hub" for the process of Knowledge Exchange (KE) of benefit to the UK industry. KE encompasses market intelligence and technical information derived from scientific research delivered by institutes and universities with funding from AHDB in concert with other public and private sector partners. AHDB has a strong presence in the translation of research to practice as well as elevating business performance; it is committed to excellent communications with government, the public and all components of the food chain; and it is involved in the elevation of skills.
3. *Definition of "innovation" in the agricultural context*
Innovation involves introducing a new product or implementing a new practice with beneficial economic or societal outcomes. New policies can also provoke innovation. These products, practices or policies may be based on new applications of established knowledge or be founded on newly acquired knowledge. Very often, a new innovative product (e.g. a herbicide resistant crop variety) requires or enables new innovative practices (e.g. minimum tillage cultivations).
4. *Innovation as a strategic objective for agriculture*
Innovation in agriculture needs to be actively encouraged and nurtured; this requires the right policy and regulatory environment which has been substantially absent in the EU (e.g. an adverse environment for agricultural biotechnology and crop protection products). Innovation is also often driven or assisted by market conditions and adoption of an innovation may be delayed until conditions are right. For example, the practical use of clover for nitrogen nutrition of grassland swards for milk production has only been widely adopted since inorganic fertiliser costs increased even though the original innovation was introduced more than 30 years ago. By way of contrast, the unsubsidised UK pig industry has had to be continuously innovative and this enabled it to survive through a very difficult economic period in the 1990s.

⁶ The AHDB is a Non-departmental Public Body and is funded from statutory levies that are generated from six different sectors of UK agriculture: beef and sheep (EBLEX- England only); pigs (BPEX – England only); dairy (DairyCo – all of GB); cereals and oilseeds (HGCA – all of UK); potatoes (PCL – all of GB) and horticulture (HDC – all of GB). Levy-derived income is approximately £50m per annum. Arrangements for devolved governments differ for arable crops (Northern Ireland) and the meat sector (Scotland and Wales). The poultry, pulses and sugar beet sectors (who raise a voluntary levy) also sit outside AHDB which therefore acts on behalf of about 75% of UK agricultural production. In addition to farmers and growers, revenue to AHDB is received from abattoirs, millers, maltsters and potato processors. AHDB is committed to delivering good value for money to all its levy payers.

5. *How is the EU innovating now?*

Policy drivers such as the need to mitigate greenhouse gas emissions or reduce reliance on chemical pesticides are drivers of innovation in the EU coupled with accessible technology. This has led to changes in priorities for crop and animal breeding, the widespread adoption of precision agriculture techniques based on GPS and innovations in the diagnosis of both crop and livestock diseases. BPEX (a Division of AHDB) has a special innovation fund which it uses to pump-prime novel ideas and several agricultural charities (such as Nuffield) fund fellowships to allow farmers to search out and introduce new ideas into their businesses.

A classic case of the stimulation of innovation was experienced in the UK pig sector during the last 8 years when the industry was severely affected by a 'new' circovirus disease called post-weaning multi-systemic wasting syndrome (PMWS). This caused acute problems with post-weaning mortalities in some herds being over 30%. There was also associated conception failure and litter size problems in multiparous sows and the overall economic impact was severe. The whole industry was galvanised into rapid action and the allied industries worked closely with producers and veterinarians to find solutions. There is no doubt that if this had not happened the industry could have disappeared completely from the UK. The essential innovation came in the form of novel vaccines generated by at least two vaccine companies, coupled with producers and the veterinary profession devising a so-called 20 point plan of husbandry techniques that significantly reduced the scale of the problem. Producers themselves certainly played a very important role in this innovative process and the whole industry pulled together to develop the solution.

6. *Obstacles to innovation*

A motivating policy environment is critical. For example, in the EU, the hostile environment to GM crops aided by a costly and malfunctional regulatory regime has stifled innovation in crop genetic improvement. There has also been an erosion of the EU skills base in agricultural sciences and little institutional motivation for translation of scientific advances into practical outcomes. Low profitability and a poor ratio of risk to reward has also been an inhibitory factor. In the beef and sheep sector, a preoccupation with "breeds" (physical appearance as distinct from beneficial performance traits) has slowed the adoption of innovative genomics-based approaches to increasing genetic potential of herds.

7. *Demography*

The age structure of the industry is such that most decision makers are over 50. However, there is a substantial cadre of innovative young entrants into agriculture who see opportunities on the back of growing global demand for food. Age is not an impediment to innovation. We do not see this as a major issue provided that succession is stimulated by the right policy environment such that the farming "profession" is valued by society.

8. *Future challenges*

Economic circumstances and uncertainty (eg. price volatility) invariably present the major challenge to agriculture. Reducing costs and responding to the regulatory burden as well as reducing inputs are all major current challenges throughout the industry. However, the inevitable global increase in demand for agricultural products coupled with

population increase and pressure on natural resources, including land and energy should provide the EU with opportunities, particularly in the North. The key strategic challenge for the EU and the UK is to ensure we grasp the opportunity offered to improve our food security situation by exploiting our access to a sufficiency of good land and water, resilient fertile soils and an improving climate. International trade in food commodities (such as soya) may come under strain when supply and demand for food are out of balance and conditions for food production in much of the rest of the world are likely to become increasingly more difficult.

9. Knowledge and Innovation systems

Innovation is certainly fostered by a close and regular two-way interaction between researchers and end-users such as farmers, processors or suppliers of products. Government has a role in encouraging and fostering these interactions. Close awareness of end-user needs among the research community and of the opportunities presented by advances in scientific understanding among end-users is essential for effective innovation. In recent times these relationships have become more remote but are fundamental to the translation of science into practice which is at the centre of AHDB's purpose. Innovation that responds to the need to reduce GHG emissions from agricultural production will be important but there is a particular challenge in engaging with those producers who are not technologically literate or receptive but where the greatest gains are to be achieved.

10. Research and Development

Agriculture is a science-based activity where competitiveness is dependent on innovation which is in turn reliant on the acquisition and application of scientific knowledge. However, agriculture is also a fragmented industry comprising a large number of diverse businesses. It is impossible for even the largest farming operation to fund its own research activity; this must be provided by government in concert with industry. Various forms of public-private research partnership (such as LINK schemes or the recently initiated BBSRC Crop Club) help to ensure appropriate targeting of public funds for greatest practical impact. In the UK and other EU countries a substantial amount of government funding notionally directed to agriculture is delivered in the absence of industry influence. It is appropriate, particularly in times of austerity that end-users should be influential in the determination of priorities for resource allocation. Sequencing the wheat genome (funded by BBSRC) and immediate release of the data for use by commercial breeders is a good example of an appropriate publicly funded activity that should result in valuable downstream innovation (e.g. in more efficient development of improved wheat varieties).

11. Education and Skills

Over the last 30 years there has been continual erosion of the expertise base in agricultural and horticultural sciences in the UK and elsewhere in the EU. There are also fewer places providing formal high level training in practical skills. At the same time, it is necessary for the industry to become more professional and the uptake of innovation demands receptive end-users. The UK no longer has an "advisory service" and technical advice is provided primarily by distributors of products (animal feed, fertilisers, machinery etc.) or commercial consultancies. Such organisations do provide a training environment and the requirement for formal qualifications such as BASIS and FACTS is valuable. Nevertheless, there is a generally held view that the industry has a skills deficit and has not been seen as offering attractive career opportunities.

12. Knowledge Transfer

Knowledge Exchange (emphasising a two-way process between researcher and end-user) is considered a more appropriate term. The KE function is central to what AHDB seeks to orchestrate on behalf of its levy payers. However, AHDB cannot hope to be successful in this venture alone and has to partner with research providers (in academia and industry) as well as the commercial sector (distributors, veterinary practices, consultants etc.) to be successful. Considering the volumes of public funding in the UK and the EU allocated to upstream investigator-led research of notional relevance to agriculture, it is disappointing that relatively little resource is made available for effective translation and the KE process.

13. EU Policies

EU Framework programmes have been highly effective in building transnational networks and seeking to gain added value from national funding for research. However, much of this research responds to policy or informs policy. Tangible outcomes from EU Framework projects of direct and immediate benefit to EU agricultural production and competitiveness are not as abundant as the scale of funding might suggest should be the case.

21 September 2010

Written evidence from the John Innes Centre (IEUA 22)

The John Innes Centre is a BBSRC- funded research centre working in the field of plant and microbiology biology. Our aim is to gain an understanding of the biology of plants and microbes and apply this knowledge to the benefit of society and the environment. Specifically, our research provides knowledge and resources for crop plant improvement by exploring and understanding the relationships between the environment, genotype and crop productivity.

Definition of “innovation” in the agricultural context

1. We have outlined above how we currently perceive “innovation” in the agricultural context, but we would welcome views on your interpretation of innovation in the agricultural sector.

Innovation, to be effective in achieving sustainable intensification of crop productivity and in diversifying end uses of plants, needs to be applied to the whole knowledge supply chain, from the lab to the field. In the specific case of JIC and other research centres, the key innovations involve devising resources and strategies for accelerating breeding using genomics, and in identifying genes that can be used in GM approaches to crop improvement. The pipeline for introducing such novelty into the field requires the intermediary action of large multinationals that can provide the resources needed for applying discoveries. Currently there are only a few companies with this capability- Monsanto, BASF, Bayer, Syngenta, DuPont.

Innovation in EU agriculture as a strategic objective

2. The EU believes that innovation and knowledge are key to the EU's economic growth and that all sectors should play their part. Do you agree that innovation in EU agriculture should therefore be pro-actively encouraged? Alternatively, do you see agriculture as a distinct sector faced with particular challenges to which the sector will inevitably react in an innovative manner?

Agricultural innovation is essential for economic growth and developing a sustainable future in Europe. Faced with increasingly challenging growing conditions, limitations of key resources such as water, and increased competition, the EU must invest in the science and innovation required for sustainable production and food security. Failure to implement GM technology will soon make EU agriculture uncompetitive and reliant on US multinationals for innovation.

Innovation today

3. How is EU agriculture innovating now? Can you explain under what conditions the agricultural sector is best placed to innovate? Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?

Within the JIC context of supporting research in plants and their pathogens/symbionts, the current national bans affecting GM crop production in the EU are having a significantly deleterious effect on the funding of underpinning plant science. The main driving force in crop innovation comes from the US and focusses on their crops, leaving key EU crops such as wheat etc as orphans, with relatively low levels of innovation. This is leading to production losses and potential for shortages.

Obstacles to innovation

4. What are the current obstacles to innovation? Is there a shortfall in research capacity and in technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their businesses?

Again, the issues of the lack of political will, short-sightedness of policy makers and strident unformed opinions will soon have a devastating effect on the efficiency of EU crop production. Already soy meal, a key animal food, costs more to be sourced through non-GM supply chains, adding directly to food production costs. Another obstacle to innovation is the relatively low levels of funding for fundamental and applied research relevant to agriculture compared to that allocated to human biology. Given the essential need for safe and nutritious food, and the imminent threats to food supply, the balance of research funding is inappropriate.

Demographic structure of the sector

5. To what extent is the demographic structure of the sector (an ageing farming population) an obstacle to innovation; and, conversely, might greater innovation in agriculture serve to bring new recruits to the sector? What incentives currently exist to encourage young people to agriculture; what further efforts might be made?

Farmers are generally highly innovative whatever their age. The changes in land management, with fewer larger farms, increased specialised mechanical and other services, and increased

corporate ownership, all tend to promote the uptake of innovative practices. Training the farmers of tomorrow, who will need to be equipped with more technical and managerial skills than ever before, is a high priority. JIC is actively engaged in providing aspects of such training.

Future challenges driving innovation forward

6. Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

These challenges have been clearly articulated in the Royal Society report on Food Security. The main motivation for agricultural innovation should be based on the need for sustainable food production and for the use of crop plants for the production of new materials. The responses should come from scientists and policy makers; the responses should be delivered by funding agencies and industry.

Knowledge and innovation systems

7. Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

In the context of EU agriculture, new research funding modalities, including coordination of national activities, is proving to be adaptable and focussed. In contrast, funding from EC sources continues to suffer from an opaque and cumbersome priority setting process, the atomisation of research activities, and a cumbersome bureaucracy. Fundamental reform is needed to mobilise innovation within the EU context.

Research and Development

8. Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

R&D is essential for generating the knowledge needed to meet the unprecedented challenges arising from climate change and environmental sustainability. The research agenda for EU-wide responses can be set directly through stakeholder groups such as EPSO, PTPs and so on. It is to be hoped that food security and sustainable food production will have a high priority in BIS. It won't cost much to invest in the future.

Education and skills

9. What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

Providing training down the knowledge supply chain is an important challenge. For example, equipping breeders with bioinformatics and genomics skills, and increasing the number of crop breeders is a key priority. New training networks are being put in place for this, and JIC contributes to these.

Knowledge transfer

10. How should research be translated into technology transfer and advice to practitioners? What are the respective roles, for example, of professional advisers, professional organisations, peer groups and the public sector?

There are important roles for all these players in the knowledge supply chain. Focussing on innovative technologies for crop improvement, public sector funding for relevant basic research is key, as is the identification, protection and licencing of technologies to major companies with the know-how to reduce such inventions to practice and provide seeds to the agricultural market.

EU policies

11. What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

As described above, the EC R&D programmes have the potential, in terms of financial volume and reach, to be a primary driver of innovation in the EU context. However EC funding modalities are insufficiently agile, and lack clear avenues for setting research priorities and focussing resources.

September 2010

Oral evidence, 10 November 2010, Q 38–106

Evidence Session No.2. Heard in Public.

Members present

Baroness Sharp of Guildford (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter

Examination of Witnesses

Witnesses: **Dr Mike Storey** [Head of R&D, Potato Council (for AHDB)] and **Mr Nigel**

Penlington [Environment Programme Manager, BPEX (for AHDB)].

Q38 The Chairman: Good morning and thank you very much indeed for coming. I'm Baroness Sharp and I am standing in as chairman for Lord Carter, who unfortunately couldn't be here today. Can I just cover one or two formal things? You have in front of you a list of interests that have been declared by Committee Members. This is a formal evidence-taking session of the Sub-Committee and a full shorthand note will be taken. This will be put on the public record in printed form and on the parliamentary website. Before it is put on the public record, you will be sent a copy of the transcript and you will be able to revise it for any minor errors.

The session is on record. It is being webcast live and will be subsequently accessible on the parliamentary website. We always wonder how many people listen to it when it is on such a website, nevertheless, it is available to be listened to and you can go back and listen to it yourselves if you wish to. It would be very helpful if we could begin by you stating, for the record, your name and official title. Could I ask you perhaps if you will just introduce yourselves? I don't know if there's anything you'd like to start off by saying before we go into questions or whether we go into questions more or less straightaway.

Dr Storey: I'm Dr Mike Storey. I'm the Head of Research for the Potato Council, which is one of the divisions of the Agriculture and Horticulture Development Board.

Mr Penlington: I'm Nigel Penlington, Environment Programme Manager for BPEX, the pig levy board and my responsibilities include environmental issues for the pig industry along

with new technologies, part of the R&D programme, and trying to encourage pig producers to be more innovative—

The Chairman: How do you get to BPEX from the pig industry?

Mr Penlington: I'm an agricultural engineer and it was through my experience with dealing with environmental issues on manures and slurries and odours and so on, which then evolved—

The Chairman: What precisely does BPEX stand for? It's British Pig—

Mr Penlington: We were the British Pig Executive part of the Meat and Livestock Commission.

Q39 The Chairman: We were wondering about the initials. Perhaps I might start off by taking you up on this whole question of innovation. You say, in paragraph 3 of your evidence, that innovation involves introducing a new product or implementing a new practice with beneficial economic or societal outcomes. Do you think innovation always delivers beneficial outcomes? Do you have experience of any negative impacts on individual businesses of innovative developments that may be positive for the sector as a whole? How do you assess the impact on individual businesses rather than on the sector as a whole; the innovative response you describe, for example, in the UK pig sector to the post-weaning multi-systemic wasting syndrome? What are the differences in openness to innovation between the sectors represented by the AHDB and how do you explain them; and if the Government is to be involved in encouraging agricultural innovation, as suggested in your paragraph 9, where should its policy emphasis lie; targeting the most innovative businesses or the least innovative businesses? Perhaps you could give us some views on those issues.

Dr Storey: I think innovation is crucial to the development of the agricultural industry. Delivering beneficial outcomes is important, but whether there is a negative impact really depends on your perspective within the supply chain and innovation can put competitors or parts of the agricultural supply chain at a disadvantage. For example, look at innovation in cereal breeding, on the development of a new resistance gene to powdery mildew in barley. The discovery of that gene and integration of that into new barley varieties led to variety resistance to powdery mildew. That had previously been protected using plant protection products, fungicides. The introduction of the new resistance gene in the new varieties certainly had a negative impact on those ag-chem businesses that had been innovating and bringing forward new fungicides for control of the disease. So it's the balance between exploiting new technologies that will address a problem and, if you like, technologies that have answered that problem in the past being superseded. It's really going to be how we mix the technologies that are coming forward with the existing technologies to make best use for the sustainability of the industry.

Mr Penlington: I have not a lot to add to that. It is difficult. Perhaps if smaller businesses can't invest to be able to take on the innovative technologies as well, that can be a barrier. On things like the ammonium nitrate versus urea argument, there's a preference for the use of urea as a nitrogen fertiliser. It has more negative effects on the environment compared to ammonium nitrate fertiliser, but the market forces are driving farmers down one particular route.

Q40 The Chairman: Of course, innovation can be seen as creative destructiveness and the whole process of moving forward inevitably means, to some extent, there are some losers and some gainers. It is about the balance. How about this second issue of looking at the process of innovation within the individual sectors? You cite, for example, the PMWS thing in the pig sector and looking at how you assess the impact on individual businesses there.

Mr Penlington: There has been a very significant improvement in the performance of those businesses because their productivity has increased. They're basically reducing mortality within their pig herds so they're getting more pigs that are born through to slaughter; so then they have more product to sell.

Q41 The Chairman: What was the process of diffusion in that case?

Mr Penlington: It was mainly through the levy body but also working with the pig vets and the supply trade to stimulate demand and make the whole pig industry aware of what was on offer and the potential benefits of participating in the large-scale trial. The farmers could see the economic benefit of having a go.

Q42 The Chairman: The implication of what you say in your paper is that, to some extent, because the pig sector was less protected by subsidies than other sectors, the process of diffusion was quicker than it might otherwise have been.

Mr Penlington: Yes, and I think because it hasn't been supported we have very much shorter, integrated supply chains and fewer larger players within the industry, a bit like the poultry industry, rather than hundreds or thousands of smaller individual farmers. So it was easier to get engagement because you have fewer decision-makers in the chain.

Dr Storey: I think that's a very similar position to the potato industry as well. You only have about 3,000 potato producers in this country producing the national crop. They have very tight supply chains and those have developed, driven by market forces. Potatoes have not been a supported commodity at any time and it's been very much driven forward by the marketplace. Processor and retailer innovation has played an important part in the development of the sector. Looking at what the consumers' requirements are and how the supply chains can deliver those new products into the marketplace has been key.

Q43 The Chairman: Looking across the agricultural sector as a whole, do you see differences between sectors here in terms of the openness of innovation?

Mr Penlington: Yes, it's quite significant because of the character of the different individuals and the businesses that you're dealing with; especially between the supported and the unsupported sectors. Most farmers are looking for a return on their investment but it is the structure of their industry and how willing they are to engage and connect to their customer.

Q44 The Chairman: And on the whole, the unsupported sectors you think pick up innovation more quickly than the supported sectors?

Mr Penlington: They've had to survive, so I guess they're probably more willing to fight.

Q45 Lord Giddens: I'm just wondering about this case in the pig industry where you say it's a classic case of innovation but, in this case, there was a shock and an imminent catastrophe and people pulled together for that. But that wouldn't seem to be typical of the

vast majority of cases of innovation that presumably are not driven by those factors but something more continuous and something rather different.

Mr Penlington: Yes; there was a particular problem which needed to be addressed within the industry. They'd been living with the disease for a number of years and new technology came along which gave them the opportunity to break out of that cycle. So they went for it but it had to be stimulated by the leaders of the industry.

Q46 Lord Giddens: What I meant was that might be a rather unusual situation of innovation and not generic. When you get a shock, it does stimulate people to action in a way that is not the case when you have orthodox humdrum farming, where you have someone poised to innovate and nobody wants to take that innovation up, whatever it might be, so I just didn't think that was perhaps a typical case but a rather unusual one.

Dr Storey: There are other examples where, if you like, shocks to the system have to drive innovation. For example, the review of the pesticide legislation with the loss of a range of products, making people think about new solutions to controlling a range of pests and diseases. I'm involved with CIPC stewardship for sprout suppressants for potatoes. Legislative changes have required the industry to look at innovative approaches, to address a problem, whether that's engineering solutions, through storage, new application technology, or new formulations. So there has been a challenge put out to the industry and there's a response there. So what Nigel's spoken about on the pig side is not an uncommon challenge that agriculture has to face.

Q47 The Chairman: One of the reasons why we have picked up on this particular inquiry, on innovation in agriculture, is because our previous inquiry was looking at climate change and agriculture within the European Union and we felt that the industry really needed to innovate in order to meet the challenges of climate change. In that sense, if the Government is to be involved in trying to stimulate innovation, where would you like to see the policy emphasis; from the Government or, in this case, from the Commission? How would you like to see them encouraging agricultural innovation?

Dr Storey: I think adopting innovation carries a degree of risk and it's being able to support businesses in that early environment when risk is higher. The way that CAP funding works at the moment, it isn't rewarding or providing that opportunity. So perhaps looking at the CAP funding, providing an incentive for new business entrants, capital investment to take up innovative enterprises, provide a basis for new businesses to go forward would be one way of looking at that. I think the agri-food industry is not generally seen to be forward-looking and economically thriving in comparison to the urban environment. Given where we are with climate change, as you mentioned, and questions about food security, Europe is in a strong position and we have to be in a position to support that innovation in the long term and look at agriculture as one of the solutions to the problem rather than as a problem within Europe and a constant drain on European funds and UK funds.

Q48 Baroness Parminter: Following on from that; I've been reading your submission and from what you've just said, it does seem to me that you see the negative impact of the EU policy as being rather hostile towards delivering innovation in agriculture. You touch briefly on the CAP, and obviously that's about to be reformed. In addition to that, is there any other way that one could create a policy framework in Europe that is more positive towards innovation in agriculture?

Mr Penlington: Regulation is very risk-averse and we have a lot of regulation now that is to deal with or to counteract problems from the past, from older technology such as dealing with nitrates and ammonia emissions and so on. As we're going forward into the new era where we need to address greenhouse gas emissions to become more efficient, then regulation to deal with tail-end problems becomes less critical.

What we'd like is an environment where the businesses are encouraged to be as efficient as possible, taking into consideration all the other aspects such as social responsibility, welfare and so on that then makes those other things less crucial. Within the pig and poultry industry at the moment, we have numerous examples of regulation, especially the IPPC regulations and the environmental permitting where farmers have to jump through a number of hoops to comply with their permit and if they want to innovate, then they have to demonstrate, which is quite right, the long-term efficacy of what they're proposing but sometimes that is a barrier to them investing. There's an example at the moment with a poultry producer that's invested in a fluid-bed furnace for combined heat and power to burn his poultry litter in exactly the same way as much is burnt in power stations, but he wants to do it on his farm and use the heat and the electricity on his farm at the point of source. The regulation has made that particularly difficult but it's a solution that could take the industry forward.

Dr Storey: I think the other challenge that we face is conflicting policy objectives between different DGs: between DG agriculture and Sanco in relation to food quality, food safety and production incentives would be one area, and these have been picked up by colleagues. Perhaps that mirrors some of the challenges we face in the UK where there's BIS, Defra and Department of Health, and perhaps the integration between those organisations needs to be better, looking at the overall framework for agriculture and what agriculture is going to produce because, at the end of the day, the consumers are looking for the production of safe, healthy foods that are affordable. There are areas where there are conflicts in the policies between the different departments to achieve that.

Q49 Lord Lewis of Newnham: If I can touch on that slightly. One of the real problems I've seen with the situation that you're talking about of combined heat and power-type approaches, of course, is, if you look at it, the waste industry as far as agriculture is concerned is equivalent to the size of the municipal waste industry but it's not being dealt with in the same degree and detail. Yet, if you go to some of the countries in Europe, you find that they have been addressing it. Now, you mentioned earlier your pig slurry and things of this nature; we had an occasion to visit Denmark eight or nine years ago and I was absolutely amazed at the extent to which they were using slurry to generate and produce within their own particular sites. How far is that particular aspect developing and are you running into problems of the same sort with Defra over this? Is it a matter of size? Of course, the old argument in many agriculture industries was to burn something. Now, incineration has become the forbidden fruit, as it were, of this particular situation, yet you now have this mountain of plastic that is being produced and the plastic isn't readily recoverable because it's called dirty plastic. What's happening as far as that side of life is concerned, because it's an enormous problem that must be facing the whole of the agriculture industry?

Mr Penlington: Yes. Certainly on the manures and slurry side, there's a huge drive to take on the technology that they have been using in countries like Denmark and the Netherlands, where they were driven down that road earlier by legislation. Now we have economics driving it in this country and there's far more good practice being applied across the board,

probably more than is recognised. Once farmers see the benefits and they understand it, then they're going for it and part of our job as levy bodies is to promote that.

As you mentioned, waste products such as agricultural plastics are a huge challenge and there's a lot of work to do to help farmers understand that they need to think longer term on how they're going to deal with those. There are farmers that are looking for innovative solutions to deal with them such as baling-up of tyres to make structures, or farmers who are entering the recycling market and trying to recover the plastics, but also part of our work is trying to identify how we can just reduce the use of them within the industry or use them more effectively.

The Chairman: Of course, as you were saying earlier, regulation stimulates innovation on occasions. If there are constraints on the use of plastics, you begin to look for ways around it. As I say, it does in itself provide a stimulus to innovation.

Q50 Baroness Howarth of Breckland I was just interested in your view of the EU in relation to value for money because at the end of your evidence you mention that the outcomes, if you like, are not as abundant as the scale of funding might suggest. I just wondered if you had any sense of the size of that, the quantity of your evidence, because that obviously is a quite powerful argument at the moment for ensuring that the EU funding is appropriately used.

Dr Storey: I think that may well refer to the comments about the research investment.

Baroness Howarth of Breckland It's about the policies; you were talking about the framework.

Q51 The Chairman: How far do you see the EU, and the CAP as a whole, as supporting innovation?

Mr Penlington: The industry will react in response to CAP in the direction that it's sending it and yes, people will see opportunities; others will see barriers and it's trying to identify those people and encourage those who see the opportunities.

The Chairman: What you were saying earlier indicated that where there is support, to some extent it encourages perhaps people in lazy ways by taking things too easily.

Q52 Baroness Howarth of Breckland I was really trying to get a sense of what you meant by the scale of funding suggesting that the outcomes were not as great as they might be and, therefore, in terms of the investment and the value for money in the European Union, how that might, if you like, be better directed to get those outcomes.

Dr Storey: I'm looking at it from a personal perspective and perhaps Professor Crute can come back with more details on this. The involvement in European research programmes in response to the policies that are set, there's an involvement in multi-national research programmes that build up very good networks between research centres which I would have expected and, from some of the areas that I've been involved in, would have perhaps delivered more in terms of practical research information coming out of those research programmes. The research programmes have been perhaps at the more fundamental or strategic level of science and there's not been the opportunity for that research to be translated into more practical, tangible outcomes that would deliver practical benefit to the farming industry where that relates to understanding nitrogen use in crops. That's one area I can think of, or a number of disease control programmes that have been multi-national. There's been good science carried out with appropriate investment but then there's not

been the translation of that, if you like, more strategic science to deliver practical information that can be used by agriculture, by growers.

Lord Lewis of Newnham: You're basically criticising the Framework Programme as a whole. I mean, this is really a fair criticism. I've seen this in other areas as well, that one is dealing with basic science and the potential applicability but there then can be a step move to implement it.

Dr Storey: It's the translation from that more strategic science to give practical advice from multi-national programmes. It is that translational step. I think the areas that are identified within the Framework Programmes can be appropriate or are appropriate and the science is good, strategic science but it's that translation, yes. That reflects not just on the ability to translate that science in the UK but in other member states as well.

Q53 The Chairman: Would you like to see the EU adopt some sort of strategic innovation programme in agriculture?

Dr Storey: It's the translation of that strategic science, yes.

Q54 The Chairman: Yes; I realise that but the Framework Programme picks up, as you rightly say, a lot of the basic stuff but what you're now looking for is something that will pick this up and carry it forward. Is an overall EU-driven programme something that you would favour here, or do you think this is for member states?

Dr Storey: I think that would be valuable because a number of the issues that we need to address nationally are perhaps better addressed by international scientific collaborations but we have to have access to all of that information that's supported across the EU and then you can draw it down and use it within national programmes, because how that information is then interpreted and used depends on the different production environments.

Q55 Lord Lewis of Newnham: The irony of this to me is simply, of course, that if you look at the history of the Framework Programmes, the initial ones were designed whereby the primary involvement in this was industry and the university sector was a secondary involvement. This has now gone through a phase. In my understanding, at that stage, I would doubt very much whether agriculture was included in the initial Framework Programmes, but now it has reached the stage where there has been a re-emphasis towards the university side with the industry still being there but in perhaps less of a role than initially.

Mr Penlington: I think in the agricultural industry, because it's made up of a lot of small players and very diverse businesses, it's harder compared to the large single business. However, certainly within our research programme, everything that goes forward now has to have an element of knowledge exchange built into that programme and that's probably where the EU framework is lacking, because it's getting to the universities and we're not making that next jump down; it's a bit far off.

Q56 The Earl of Arran: Research and development is perhaps the most important thing of the whole lot. Given that much government funding directed to agricultural research is delivered in the absence of industry influence and that the end-user should be influential in the determination of priorities for resource allocation, I have three questions. Firstly, can you give examples of what you mean by this in the UK and the EU? Secondly, what do you believe to be the role of the consumer in determining research priorities? Thirdly, and I think most importantly, obviously government funding is going to fall away significantly. What suggestions do you have to encourage more private sector investment in R&D?

Dr Storey: Certainly there is an absence of industry funding. The largest funder of the agriculture-related R&D and food-related R&D is the BBSRC. There's only one farmer on the council of BBSRC. It's dominated by academics. There's a majority of academics on BBSRC and there is an involvement of the supply side represented in the ag-chem sector and the animal health sector. The funding decisions, the panels that make the decisions, are certainly dominated by academics.

One of the exceptions is the Crop Club that has been developed where there is industry involvement, but the funding for that is only £6 million and that's small in comparison to the total BBSRC budget. There are examples of where projects have been developed and the industry's not been aware of the development of those projects and could have been involved. I know there's one within the pig industry that involves the University of Cambridge and the Royal Veterinary College. It was on respiratory diseases and that collaboration has been carried out with the Chinese industry, not the British industry. So there are gaps there in engagement between the research council and agriculture.

I think the other funding coming perhaps from Defra is very much policy-driven rather than industry-driven. A different example, though, where there is good engagement is perhaps with the Scottish Government. With the way that the research funding is structured, the Scottish Government are responsible for the breadth of funding from the, if you like, strategic side that they support through to the more applied work and linkage in with the Scottish Agricultural College for the delivery of that. There's a much more holistic view taken by the Scottish Government compared to the different departmental remits that have responsibility for funding of institutes in England and Wales.

Mr Penlington: I'd also like to add that the levy bodies' research programmes are driven mainly by the end-users, so we have committees that comprise a mixture of academics, end users and supply industry all putting forward ideas and assessing the ideas that have come forward to see which ones are going to deliver the greatest value to the industry.

Q57 The Chairman: If the BBSRC were to work more in collaboration with you, what body would represent the agricultural industry? Would it be the AHDB?

Dr Storey: The AHDB certainly have an interest in greater engagement with BBSRC. That is already happening. Meetings have been held since our establishment, but we're looking at the position we are in now and the funding picture that we have at the moment and I think that reflects the lack of industry engagement over recent years.

Q58 The Chairman: Yes. Back in the 1990s, I did quite a lot of work looking at the interaction between the pharmaceutical companies and some of the research councils. In that case you have a very close collaboration obviously going on and interchange with them, and a large number of their executives sit on different research councils. Then they played a very active part in helping develop a number of programmes within the research council. Would you like to see more of this, so to speak, much closer interaction with your own organisation and the research council than you have at the moment?

Dr Storey: Yes, I think we would because the funds that we have from industry are limited.

Q59 The Chairman: Have you talked to the research council about doing this?

Dr Storey: We have. There have been discussions with BBSRC, by our chief scientist Professor Crute with BBSRC representatives. Certainly we, as levy organisations, only have limited funding and we have to make best use of that and seek to influence the funding for strategic research where we believe that the greatest benefit will be achieved for the

industry and so that we have, if you like, that pipeline running from the basic research through to supply.

Q60 The Chairman: Yes. You are funded through levy payments. Now, picking up the question that Lord Arran put, given the tightness of the government budget and the research councils—although the science has been preserved in money terms, in real terms, it's going down—do you see your organisation being able to contribute more funding to some of this research?

Dr Storey: One of the reasons for the establishment of the AHDB was to make all of the six organisations that come together more financially efficient. That is happening in terms of back office functions being combined and that is allowing a greater proportion of funding to go to frontline delivery, whether that's research or Knowledge Transfer (KT). We are seeking to maintain our investments in research and KT. We do recognise that it is tight within the industry and there is a limit to how much funding we can seek from our levy payers. But that is subject to discussions on an annual basis as to where we set the levy and we're setting the levy to meet the objectives that our levy payers are asking us to deliver.

Q61 The Earl of Arran: Can I just have one quick question? Is there any cross-pollination of your findings between your research body and other research bodies? Is there any centralisation or is it all done independently?

Dr Storey: There will be linkages between the research that is carried out under contracts for the different AHDB divisions and BBSRC and Scottish Government, because, quite often, it's the same individuals or institutes that are carrying out work or and there are good linkages within the programme areas.

Q62 The Earl of Arran: Is there much duplication?

Dr Storey: I don't believe so because our levy payers and our research committees look very, very carefully, and that's one of the first questions that we are asked; is there any duplication in the investment that we're putting in? That is a crucial question to levy payers.

Mr Penlington: May I also just add that when we're talking about financial contribution or contribution to the programmes within the AHDB, they might not always just be financial contribution. We have our staff resources that we can contribute into partnerships and we do that very regularly. So there are other things we can add.

Q63 The Earl of Caithness: I'm going to pursue the same points as the Chairman and Lord Arran just raised, about your role. You call yourself a hub but you're not a complete hub. You have an extraordinary range of activities. Sometimes you're representing England, sometimes you're representing Great Britain and sometimes you're representing the UK. That's a mighty inefficient way to run any organisation. Should you be UK-wide and if you cannot be UK-wide because of the devolved situation, could you expand a little bit more on your relationships with the devolved Governments and how that works? I would just add that I am not at all surprised that you say the Scottish Government is a great deal better than Defra at handling research.

Mr Penlington: Within the pig industry, we're one example that we only look after the interests of the English pig industry. That only came around because the Scottish pig industry is relatively small and in the hands of a very few players and they decided that they could work better with their equivalent organisation, Quality Meat Scotland, for their activity north of the border. That doesn't say that we're totally disconnected from them but that

was the levy payers' choice and it's the same within Wales. There is a very small pig industry within Wales, so we represent the cause where we can be more efficient.

Q64 The Earl of Caithness: How do you work with the Welsh and the Scots and, in certain cases, the Irish?

Dr Storey: From the potato perspective, we cover GB, so we work effectively as a single industry. It's certainly true that where there are linkages, perhaps research linkages, they will be through individual projects and priority areas where there's a common problem. That will be done on a project-by-project basis.

Mr Penlington: Within the pig industry, we work with QMS and with HCC in Wales on individual projects. We have close contacts through our knowledge transfer managers to our research and development programmes, so we're not working in isolation and we exchange ideas and information with them, so they are almost like a local office. I think the interesting thing is that we recognise that we're all in the same industry going in the same direction and it expands beyond just the UK shores and we are developing networks with our European counterparts as well, so that we can take in the bigger picture.

Q65 The Earl of Caithness: But looking at your financial position, do you think that your levy agreements will continue, and do you think you'll remain a public body? Shouldn't you, in fact, be looking much more commercially and commercialising your existing research to make that a profit source rather than trying to seek out new research?

Dr Storey: We have been set up as levy-funded organisations; that's the remit that we have. Certainly there's been unanimity between AHDB and Defra that we need to retain the statutory levy at the moment but, going forward, we've identified that there needs to be a debate within the industry about the funding structures. That will be happening going forward with all the sectors.

Q66 The Earl of Caithness: That will be happening; so it's not happening now?

Dr Storey: That decision just came from the recent review and we've been asked to take that forward as an organisation. It's what would have been happening as a matter of course by AHDB because we are in discussion with our levy payers each year as to the range of activities that we undertake on their behalf. How we operate in terms of funding research, delivering knowledge transfer, delivering market information to the industry on behalf of the industry.

Q67 The Earl of Caithness: On your operation because you've just mentioned that, are you instructed by the people from whom you get the levy to do research into a certain area and it's all scientists, or are you doing research on the farms and working at the base level with farmers so that they can interpret what some of your boffins are telling you?

Dr Storey: It's the full range. The different sectors within AHDB have different requirements and different models but certainly from the Potato Council perspective, we are funding research work that links to strategic programmes that are funded by Government that's previously been through LINK and we now have the opportunity to exploit the new TSB programmes. That's a sum of money going to support more strategic work. We're funding much more applied work at universities and institutes and we're taking that information and using demonstration farms, collaborations with supply chains, which are very effective, to translate that information and put it into practice and demonstrate best practice to the

industry. So it's a spectrum of activity and that spectrum will differ depending on the sector needs and requirements.

The Chairman: I think we now ought to move on to the next question from Lord Cameron that picks up very much the same issues anyhow.

Q68 Lord Cameron of Dillington: Yes. I want to talk about knowledge exchange, which, if research is 40%, knowledge exchange—as a farmer, I prefer to call it agriculture extension that, as you know, is a two-way process, which is a much better terminology—is probably 60% of the game, which is what you're all about. I just wondered whether you have an ideal model of agricultural extension and whether that model would differ between the various sectors and what more could be done in the UK and the EU to try to promote better agricultural extension. There are probably two different answers; one to the UK and one to EU. Is an advisory service, for instance, a necessary requirement or is the Scottish model a better answer?

Mr Penlington: I think you can look at the success of the BPEX knowledge transfer team, which has been in existence now for four years, and the progress they have made within the industry of engaging with farmers. They are there to stimulate this two-way process that you describe, and to encourage the farmers and demonstrate to them, taking knowledge from one farm to another farm. Then we have a successful model there and a level of engagement with the farmers who traditionally are the non-engagers. We're getting to them now and I think that is a measure of success. The demand for the meetings and the training that they're organising demonstrates that that is probably the right way to go. Certainly the feedback coming from our levy payers is in support of that and that's reflected by two very successful conferences that were organised last month.

Q69 Lord Cameron of Dillington: The pig industry, of course, is quite a small club—becoming even smaller every year—and so it's slightly easier within the pig industry. Potatoes is quite a small club too, but the wider field of general knowledge in terms of growing comparable crops, for instance, would be a much more difficult obstacle to overcome.

Dr Storey: That is a much more challenging situation. Again, there's no single model as to how the sectors operate within AHDB and that perhaps reflects the way that our levy is collected by the different sectors. The potato sector knows each of its individual levy payers and can target those individuals with information directly, all working through the supply chains and linking into the supply chains. There's very much a business focus in the knowledge transfer bringing forward the new innovations. It's so that those businesses remain competitive within the environmental or legislative framework in which farmers have to operate.

For the broad-acre arable crops, it is much more difficult because the levy collection is not from individuals; it's collected through the supply chain. There's not the knowledge of who the individual farm businesses are and it is much more difficult to target that information. It has to be much more of a broad-brush approach, then farm businesses have the opportunity to engage or not engage and that's a much more difficult situation to ensure that the new innovations are, firstly, made known; secondly, taken up; and, thirdly, show benefits.

Q70 Lord Cameron of Dillington: What about the general structure within the EU? Is there anything that could be assisted there?

Mr Penlington: Again, every member state has its own way of doing things and there doesn't seem to be one perfect model. Also, the different industries or sectors of the industry within the different member states have a different approach and some are prepared to pay for advice and knowledge; others are not, so there's no one-size-fits-all. You have to identify your customer or who you're trying to exchange the knowledge with, their needs and then put in place the appropriate mechanisms to deal with that. But the core to it is that you need good people who the industry has faith in and who can connect.

Dr Storey: I think a lot of what we've just been focusing on is the role that AHDB have had in knowledge exchange. There's obviously a wide range of others that are involved in knowledge exchange; whether they're from the ag-chem or the animal health industries, whether they're from the supply chain themselves, whether it is government policy advisers working on catchment centres or farming; there's a range of different routes for delivery of that information to farmers and the agricultural industry. All of them have a slightly different take on the message depending on the perspective that they're coming from.

Coming back to AHDB, one of the advantages that we have is we are seen to be independent of those organisations. It's our independence; we are working for the levy payers and we are investing and making sure that the information we are distributing is based on sound science. I think that independence and a sound science base is important for robust knowledge exchange.

Q71 The Chairman: Do you see yourselves therefore as the inheritors of, so to speak, the ADAS tradition?

Dr Storey: ADAS had a lot of people going down farm tracks. I don't think—

The Chairman: You don't do that?

Dr Storey: Certainly from our perspective, we have to be a lot smarter in how information is delivered.

Q72 Lord Cameron of Dillington: So what you're saying to me really is that probably using vets, agricultural suppliers, remains the best way of getting information out to the farming public?

Dr Storey: Those are a number of routes, but you have to recognise that they have particular messages that they would want to convey, for example if it's ag-chem suppliers. That has to be weighed up against the independence of the information that's available from AHDB or coming through research institutes or research centres that we've collaborated with in experimental farms, demonstration farms.

Mr Penlington: I think of those other sectors—you mentioned vets—are changing their approach as well. For example, a number of vets now act more on a consultancy basis rather than generating income through sales of product, and that's encouraging.

Q73 Lord Lewis of Newnham: Could I just turn a little bit to one of the things you say: in your paragraph 11, you say that, "Over the last 30 years, there has been continual erosion of expertise based in agriculture and horticultural science in the UK and elsewhere in the EU". Why do you think that has happened? Do you think the fact that the sector now has a higher profile perhaps than it used to have would help to improve this position and should proactive steps be taken to tackle the skills deficit and, if so, by whom?

Dr Storey: Certainly agricultural production was very successful and perhaps there was a belief that we could supply the majority of food that is required in the UK from the world markets, and perhaps the focus on training in agriculture at universities was stepped away because of that belief. I think recently there's been a far greater awareness of the needs for food security, food production and there's a realisation that we've lost skills and knowledge at universities that can deliver the training to support that. So I think it's perhaps a reflection of where we were 20 years ago and how successful agriculture had been in responding to the challenge of increasing food production.

Mr Penlington: We also have to recognise that agriculture actually needs fewer people now but it needs a different calibre of person, and very much throughout all aspects of the industry people need to be more highly skilled. Certainly that is one area where we're putting a lot of investment in, like certificates of competence for stock people to management development schemes, and the industry hasn't been seen as attractive, so a lot of good skilled people have gone elsewhere, because the financial rewards and the working environment haven't always been the best. So we've had that skills drain, but it seems as though there's a renewed interest and we have to stimulate that and carry it forward.⁷

Q74 Lord Lewis of Newnham: Are there any new departments being set up?

Dr Storey: No. We have only perhaps four or five universities that are dealing with agriculture at the moment: Reading, Nottingham, Aberystwyth, Edinburgh, so there are limited numbers of centres that are available.

Q75 Lord Lewis of Newnham: But it seems to me that, in many instances, these departments are very much research-orientated. It seems, from what you're saying, that you want the undergraduate training of perhaps a different nature to the ones that were being done in the past, and this strikes me as being ideal for the some of the newer universities to take on.

Dr Storey: That is true, and I think we have to welcome the new ATP, Advanced Training Partnership initiative, from BBSRC in that respect, which is seeking to develop training hubs for graduates and high-level skills at one level, but also the agri-skills forum that is being set up will involve the NFU, AHDB and LANTRA in terms of the skills and training recommendations. I think it would be valuable to refer to the recommendations from the Defra Fruit and Vegetable Task Force that has recently reported, and that is looking at increasing production and consumption of fruit and vegetables in the UK. There was a specific series of recommendations in that report that are endorsed by the industry to take forward skills and training at the different levels for horticulture and agriculture.

The Chairman: Well, thank you very much. I think we'll call that a day now, but, on behalf of the panel here, I thank you very, very much indeed for coming and giving evidence. It's been very valuable to us that you have given your time like this.

⁷ Note by witness: The evidence that the AHDB is aware of relating to innovative young entrants in the UK industry is a reflection of their attendance at a wide range of Knowledge Transfer events and business improvement meetings that the different AHDB sectors organise. A particular challenge that they face is, that as young entrants, they tend to be managers in larger innovative enterprises, which because of their structure are usually able to build on an established business base where a higher degree of risk can be mitigated. If the young entrant then seeks to move and establish their own innovative businesses the cost of entry and financial backing for these new enterprises can be a significant challenge. Mechanisms to support this type of business set-up will be beneficial.

Dr Storey: Thank you.

Mr Penlington: Thank you very much.

Examination of Witness

Witness: **Professor Giles Oldroyd** [Associate Research Director, John Innes Centre]

Q76 The Chairman: It is now good afternoon, Professor Oldroyd, and thank you very much indeed for coming. You, I think, have sat through all that evidence, so you've heard what has been said. As I say, thank you very much. Would you like to do a brief introduction of yourself? And I don't know whether there's anything you'd like to say to start with or whether you would like us just to go into questions.

Professor Oldroyd: Yes, I can introduce myself. I'm Professor Giles Oldroyd. I'm an Associate Research Director at the John Innes Centre. I can say a few things, just my view.

I think in some ways, when you look at the global challenges that we face, it's a very exciting time for agricultural sciences, and the advances in science mean that actually there's huge opportunities to innovate. I think we sit at the cusp of a revolution in agricultural sciences, and that's the biotech revolution. I think what we've seen in the last decade is just the beginning of that. I think there are huge opportunities to innovate; it's very exciting, but I think there are restrictions here in Europe particularly for that innovation in agricultural science.

The Chairman: Yes, in particular the whole question of genetic engineering.

Professor Oldroyd: Well, I would say there are, in my view, four major areas. There's been a lack of investment in agricultural sciences over the last 20 years, there's a decline in agricultural sciences, and you see, if you look at the investment in medical sciences versus agricultural sciences, there's a huge gulf in that. Of course, I think the GM debate has been very bad for agricultural sciences. It's put us in a very bad light in the public sector and it's really limited our ability to innovate in the sector. As a result of that, we've seen a decline in industrial investment in this area in Europe as well, so our natural partners, as scientists, are simply not there in the way they were there 20 years ago.

The Chairman: Thank you. Right, we'll move straight into questions.

Q77 Lord Giddens: Let me add my welcome to that of Baroness Sharp and congratulate you on the success of the centre. You say in paragraph 1, "Innovation, to be effective, needs to be applied to the whole knowledge supply chain from lab to the field". That sounds quite a top-down model. Do you think a top-down approach is inevitable in the current stage of innovation in agriculture?

Professor Oldroyd: There was a question of, "What is innovation?" and I think that innovation has to be encouraged. I think at the moment in the agricultural sector there does need to be significant investment in the public sector. When you look at something like the plant breeding industry, it only has a couple of million to spend on R&D in the UK, and you compare that to something like the pharmaceutical industry, where you have billions to spend on R&D. So I think there is a big gap there. At least in plant breeding, there is a real problem in investing in the R&D.

Q78 Lord Giddens: That wasn't exactly what I meant. I meant, in your view, will most innovation come from, for example, scientific work and then penetrate to the producers and the consumer, or is there is more a double relationship, with bottom-up innovation being important too? And if you think of innovation as not just technological, but social and economic, wouldn't some of that have to emanate from a lower level then—

Professor Oldroyd: Oh, absolutely. I totally agree with you on that.

Lord Giddens: How would you see the relationship between these?

Professor Oldroyd: Innovation, in some ways by definition, has to be bottom-up, because it's applying the advances in science. You can't predict what those advances in science will be in the next decade, so those advances have to come from the bottom up and have to be driven by a strong scientific foundation. So undoubtedly, the discoveries have to be bottom-up, but the infrastructure to translate that is something a little different, and I think that there's quite a significant investment right now in the basic research, and at the very end, at the supermarkets, there's a lot of money in the products, but there's a decline in the value of the product. When you get down to the actual CE value, it's relatively low, which means that there really is a gap in translation of funding at the moment that allows a chain to deliver those fundamental discoveries.

Q79 Lord Giddens: But you seem to attach a lot of the role to the big companies in this, and do you have worries about this? Because I'm not really asking about the GM debate, it's obviously relevant to that, but you do mention a bit later on that the big companies are going to have a crucial role in innovation—

Professor Oldroyd: I think they do.

Lord Giddens: But what's to stop them then dominating?

Professor Oldroyd: It's interesting. Particularly in the last decade, we've seen a coalescing in the agricultural sector to a few major corporations. That's the reality and it's interesting how when you look at the agricultural sector, we've seen that as a problem, but if you look at the pharmaceutical sector, it's not seen as a problem. So for some reason in the pharmaceutical sector, where they're controlling life and death, it's not a problem if you have a few corporations with total dominance in that area, but when you have a few corporations controlling food, it's seen to be a problem. Unfortunately, that's a reality of the times. There's not something we're going to change in that and, ultimately, those companies are the companies with the ability to deliver the discoveries that are made by the research sector.

Q80 Lord Giddens: Are there any specific innovations which you would point to as being potentially revolutionary which are sort of on the stocks already, and you would see as having a major kind of ripple effect, or is it just GM technology that you see as—

Professor Oldroyd: Oh no, it's not just GM, and it's unfortunate that the GM debate takes all signs in this sector, and the big picture is GM.

Lord Giddens: Well, it's just that you point to it quite a lot in your submission. I wondered if you—

Professor Oldroyd: So when you're talking about innovation, there is undoubtedly innovation in the plant breeding sector, and bringing genomics into plant breeding will undoubtedly revolutionise our capability in plant breeding, and we're very actively involved in that. So in a place like the John Innes Centre, we're heavily involved in the traditional plant-

breeding and increasing the capabilities of plant-breeding, but plant-breeding is limited by what you can do within a specific species, and GM is another side of that coin. And if you're talking about innovation in the agricultural sector, currently what we have is science essentially locked down in only being able to do one area, we can't actually use a very valuable technology that the rest of the world is getting on with and we can see the results of that, and companies like Monsanto are getting market dominance as a result of that.

Q81 Lord Giddens: It's sometimes said—and this came out in a previous discussion—that it's not just an issue of innovation, as such, that we're dealing with here. We're dealing also with the failure to commercialise existing knowledge and existing innovation. Do you think that that is sometimes the case: rather than the actual absence of innovation, it is the failure to translate it into some kind of practical consequences that people can actually use, because it's not taken up by either the commercial organisations or by the farmers?

Professor Oldroyd: It takes a lot to go from a discovery made in a lab to a product out in the field, and many times—this is true both in the pharmaceutical sector and in the agricultural sector—companies are often not willing to make that leap right away when a discovery is initially made. For instance, in the pharmaceutical sector, you'll see venture capital go into that investment, a small spin-out company evolve, and then as that's taken closer to market, it gets bought out by the big companies who ultimately take it to a drug that people use. There is a real gap in that process, because there are not venture capitalists willing to put money in GM in the UK, and there is not a lot of money in the public sector, and there's currently not a lot of money in the private sector.

Lord Giddens: There will be even less money in the public sector.

Professor Oldroyd: Well, exactly, undoubtedly.

Q82 The Earl of Caithness: I want to turn to the EU policies in agricultural innovation. Two questions for you: you're wonderfully condemning in paragraph 4 of your evidence about the short-sightedness of policy makers. Presumably that refers to national Governments and the EU. Should national Governments and the EU have any role at all in innovation, and if so, what should it be?

Professor Oldroyd: I think they should have a role in encouraging innovation, undoubtedly, and I think that encouragement should come in investment in the—in my case, from the way I see innovation—research base. But certainly with the agricultural sector, and particularly with food, we've seen a level of originality, particularly in the EU, and, for instance, the precautionary principle has really limited innovation in this sector. It's caused a lot of problems for us in innovating agricultural sciences.

Q83 The Earl of Caithness: One of the things that we politicians do is react to what the public think and say. On the whole question of GM and some of the negative attitudes in Europe, isn't that entirely because we were told by the scientists that that is good, and the scientists did not bring the consumers along with them and explain why it was good, and scientists lost the argument completely on a number of these innovations? And now I'm beginning to tread on the next question, but if we could just start it now and then I will shut up. What should scientists be doing more to inform people of the benefits of their innovations?

Professor Oldroyd: I agree that the GM debate was mishandled, and I think that's widely recognised now, and in fact, since the GM debate we've had things like the Science Media

Centre that's come into existence. That is essentially a national entity to better handle these kind of processes, and I think as a result of the recognition of the failure of the GM debate, we've actually been doing much better now at handling new scientific discoveries. And I think if you compare, for instance, stem cell lines, which could equally have caused big problems, that hasn't, because of an appropriate handling of that debate. And I think the problem with the GM debate is that it was just left to individual scientists in their own capacity to try and tackle this, and there wasn't support, there has never been support from Government. Government is unwilling to come outright and say, "We support this technology". They haven't come outright and said, "We do not support this technology", but it's been left to individual scientists to fight the case. And we're fighting against very irrational NGOs that have an apparently almost religious agenda on this one issue.

So I think that it's recognised now that the scientists are working very hard to bring rationality into that debate, but we're fighting against a long history and that is very difficult. I don't think that we are currently failing in the engagement with the public, but I think we've lost that debate and we have to fight back very hard.

Q84 The Chairman: But as you have indicated, there is innovation going on in the plant breeding area, for example, outside GM. What is your perception of the degree to which that innovation is being translated through to the individual farmers and so forth? How far do you—

Professor Oldroyd: Well, the mechanism for that currently is through the large corporations, so if you look at somewhere like Monsanto, they're doing pretty well at translating it to the farmers. 80% of the global soybean crop is GM now, but obviously within Europe, we don't have that. But I think if you take the other side of the coin, the other side of innovation in this sector, it's the plant-breeding sector and there we have a large degree of success and we're working very closely with the plant-breeding companies to improve innovation in this sector. One area that we're just developing is a wheat improvement network run out of the John Innes Centre that brings together all the bodies, the academic bodies, the institutes and the plant-breeding sector into a single unit to work towards the improvement of plant-breeding, bringing new genetic diversity that the plant-breeding institute can use and also bringing genomics into that sector. So I think in that area, we're very successful and innovating very well. On the other side of the coin, the GM sector, we have our hands shackled.

The Chairman: Well, as you wrote, yes.

Professor Oldroyd: It's almost impossible.

Q85 The Chairman: I understand that, but I was really thinking how far in the institute you feel that you are getting the work that you're doing out into the field.

Professor Oldroyd: I think we're doing that very successfully in the plant-breeding environment, but not particularly successful with the GM.

Q86 Baroness Parminter: Can I touch on the issue of education and the future for this area? The previous submission, and indeed the previous consultations that this Committee have done, indicated that there's a fall of undergraduates coming into this area. Your submission was quite unrelentingly negative, I felt, but hopefully there is a future in this area. How are we going to get more people to come into this?

Professor Oldroyd: Yes. At the moment, there are definitely only a small number of British students. We pick it up at the graduate level. We're not an undergraduate programme, so we're only dealing with PhDs and Masters, and we have a Masters course in plant-breeding, and then of course we run quite a large PhD programme. And the number and quality of British students who want to go into plant sciences is not high, and I think partly that's a result of the GM debate, that's put us in a rather bad light as a whole. Plant sciences does not look pretty at the moment. And I think also there's such a strong pull in the medical field that if you're in biology, the tendency is to go into medicine.

From my own experience, talking to students, it seems like we've already lost before we even get to university, and the A-level curriculum has such poor quality plant sciences in it, it tends to be just photosynthesis and water relations. While they are important, they're not necessarily the cutting edge of plant science at the moment. So when students are making their choices to go university, they haven't had a very riveting exposure to plant sciences already and they feel like it's rather old-fashioned and that all the future is in the medical sciences. So I think tackling the A-level curriculum is probably the best place to go, because when you get to the undergraduate level, if the students don't want to go into those courses, there's nothing you can do. In the last decade we have seen a decline in plant biology departments around the UK. They've merged into big biology departments, and then they're dominated by the medical sciences. So plant biology is only offered in a few places now. For instance, at the University of East Anglia I know the attendance to the plant biology module is very poor, even though they have the world-class Plant Research Institute next door and they get taught by us. So there's just a lack of interest coming in from the students and I think that needs to be dealt with earlier, before college, before university.

Baroness Parminter: That's very helpful, thank you.

Q87 Lord Cameron of Dillington: Couldn't they pep it up a bit by relating it all to fundamental world issues which—

Professor Oldroyd: Oh, I totally agree, yes.

Lord Cameron of Dillington: Because, you know, the younger generation is certainly concerned about climate change and they are likely to live out the consequences of this. You know, it's very directly related to all of these things. You have really big transformations also that could affect, for example, how plants are used in manufacturing process, which we heard from the previous session; many things you would have thought could draw students in to make them see the importance of this work.

Professor Oldroyd: I completely agree, and when I started out I said it's a very exciting time for us in the plant sciences. We've been in the dark for 20 years and I think we've finally come to prominence. We have global recognition now that agricultural science is important. And this year, when we were interviewing for PhD students, it's the first time I ever heard students say that wanted to do this because they thought the challenges of the future could be addressed by plant sciences. So I think that is turning around and I think when you look at the challenges that we face, it's less about extending somebody's life by a few months and it's more about feeding 9 billion people in a sustainable fashion. I think that younger people will start to see that, but I don't think we should just rely on that changing people's hearts and minds. I think there is a level at which we can encourage an interest in the agricultural sciences.

Q88 Lord Cameron of Dillington: A more proactive approach might help, I would have thought.

Professor Oldroyd: Yes. It will move things forward as well, but I do—

Lord Cameron of Dillington: It does sort of sound old-fashioned if we don't do that.

Professor Oldroyd: Yes, exactly, and particularly the GM debate, I think putting it in the context of sustainable food production for 9 billion people completely changes the agenda of what you're discussing. So I think we're encouraging young people and, for changing the public's perception, I think that we're in a pretty good position right now.

Q89 Lord Lewis of Newnham: Can I just take you up on this point? I agree with you that it would be very useful to involve an A-level subject in biology there. We face the fact that when you look at science as a whole, there's a much greater propensity for people to go into biology today than there was into chemistry and physics. So you're on the winning side from that point of view, but how far is this also a reflection on the actual interest of the staff, because in point of fact, if they don't put on a course in this particular area or they don't put it on with the enthusiasm that you obviously have for it, then that's when the incentives do not come through to the young. The young are very much led, I think, by the courses that they get within the university themselves.

The other important point to me is that the bulk of the people you're talking about are graduates in the sciences. What happens to the graduates in the agricultural departments? Do they just disappear into agriculture? At one stage in Cambridge I was involved in chairing the faculty of engineering, and there I discovered that the majority of research was not carried out by engineers, but by physicists. And in fact, agricultural people, I would wonder, tend to want to go in to do agriculture, not to go in to do research. And that's the entry that they get. There's a dichotomy here between those two problems. How do you view this?

Professor Oldroyd: I think in some ways, those are two different areas. Clearly the agricultural sciences is a very broad area, from fundamental research in, for instance, plant genetics all the way through to growing crops in the farm, and that's clearly a broad area. Clearly it's important that the courses are there in the universities that cover all those bases, and John Innes at the moment is involved with the UEA and Easton College, which is an agricultural college in Norwich, in combining our efforts to create a course on agriculture. That is an undergraduate course that's starting next year. So those things are happening. I can say in that instance, things are moving forward as we are offering new courses in agricultural sciences. I think it is clearly important to offer courses across the spectrum and I think that the broader higher education environment can offer everything from the sort of more agriculturally related to the more research-based sciences.

But if the students don't want to do it, the university simply can't afford to maintain those courses. The universities are increasingly driven by the economic baseline, and if the courses aren't bringing in money, then they won't run them. So if the students aren't willing to go into them, you can't force the universities to offer courses unless there's the demand on the student base for that.

Q90 Lord Lewis of Newnham: Yes, but I have a more cynical view perhaps, and that would simply be, of course, that many universities are interested in the monies that are brought in by the research groups. The teaching departments very rarely bring money in and so they do tend to wither on the vine, as it were.

Professor Oldroyd: I'm not in the university sector, so I'm just giving you my personal opinion here, but the HEFCE gives a value per student, so if you can get a lot of students

into a course, then it does pay. But often somewhere like a medical course, you'll probably have a very strong research base behind that as well as a strong teaching base and so it brings money in from both streams.

Q91 Lord Cameron of Dillington: I wanted to talk about the R&D infrastructure. In your written submission to us, you say in paragraph 7, "In the context of EU agriculture, new research funding modalities, including co-ordination of national activities, is proving to be adaptable and focused. In contrast, funding from EC sources continues to suffer from an opaque and cumbersome priority-setting process, the atomisation of research activities, and a cumbersome bureaucracy". You are quite rude about them, and I'm just wondering, in the context presumably of national activities, if you could just say a bit more about those elements which are adaptable and focused, which sounds quite good, and conversely, equally, can you perhaps expand a little bit on your criticisms of the EU funding?

Professor Oldroyd: I would say the BBSRC funding is very good. It's responsive, it's competitive and it tends to be funding the best-quality science that is submitted. There has been a drive to align European funding through, for instance, the ERA-NET scheme. It's not through EU, it's aligning through the national funding bodies in France, Germany and around a number of European countries, so if you apply for an ERA-NET project, you apply with other European partners, but your funding comes from your national body. Those have been very successful and adaptable, and they tend to reflect how those national funding bodies work, which adds a high degree of competition into the system that ensures the best quality science is funded.

The funding from the EU at the moment is in two major areas. The European Research Council is a very positive development in European funding, and that has brought in a high degree of competition and is just about funding the best-quality science you possibly can. In contrast, the framework funding tends to lack a degree of competition. It tends to be more how much influence the scientist has than how good they are at doing the science, and it tends to be policy-driven and contractual.

The whole thing with science is that it has a level of unpredictability to it. If I can tell you all the scientific discoveries I'm going to make in the next five years, I'll be delivering very pedestrian science. It's actually the things that you don't suspect, that you don't anticipate, that are often the most exciting developments, and those are the things you need to encourage. And in the Framework Programme, it presumes that we are contractual as scientists and we can say exactly every milestone and everything that we will achieve over the next five years. While we write those programmes—so they are golden handcuffs, because we've created them ourselves—it doesn't really allow any level of flexibility, any surprises or any change in the direction of the investment in the science, and it also comes with a huge degree of bureaucracy.

I have been involved in those FP frameworks: endless reporting, endless auditing. It's an incredibly bureaucratic process and there's not just a focus on the science, but it comes in with a whole load of other aspects that are all very good in some areas. If I can give you an example, there is a gender inequality in high-level science, and I think that's because of the career structure of science, but the EU has pushed that problem on to the scientists. So if I get a research grant from the EU, I have to say how I will address that gender disequity in science. I don't discriminate between men and women in who I hire for post-doctoral and PhDs and that's not where the gender disequity comes. Gender disequity comes at the higher levels, the leadership levels in science, and that's not something that I can address as an individual scientist, but the EU expects me to address that when I get a science fund.

And that's just one caveat of getting EU funding. It comes in with a huge amount of baggage that is really about scientific policy rather than the quality of the science itself, and in order to get the money for the science I have to address all these other issues the EU has decided are important to change in scientific framework. So the best scientific funding is the one that is responsive, is driven from the scientists and is flexible and highly competitive, and I think that, for instance, BBSRC, ERA-NET and ERC is that. The Framework Programme is not, and it is unfortunate that so much money goes into that.

Q92 Lord Cameron of Dillington: So is there a model for trans-national co-operation research?

Professor Oldroyd: Well, I think the best model that's working at the moment is the ERA-NET, which is an irony in a way, because we have the European Science Programme run by the EU and it's been deemed necessary to align the national frameworks as well, and actually that has a much higher degree of flexibility and responsiveness and competition than what you see coming out of the EU. The EU has heard the message to a point and has created the European Research Council, and I think that's an incredibly positive development, but we still see a huge amount of money going into the Framework Programme.

Q93 Lord Lewis of Newnham: You say, I think it's in paragraph 10 of your report, that there are important roles for all players in the knowledge supply chain. Now, what are these roles and how and who should take the responsibility for making this chain work and how do consumers fit into the knowledge supply chain? I think this is a point which we saw touched on in the previous discussions.

Professor Oldroyd: Yes. I'll address the end of your question first. I think from where we stand as the research institute, our consumers really are the plant-breeding industry and the biotechnology companies, because they're the ones who are actually going to take our discoveries and apply them ultimately to the farmer, who gets to the consumer who eats the food. I think it's dangerous to have the consumer who eats the food dictate the direction of scientific research in a research institute such as John Innes. We work closely with the plant breeding industry and the biotech industry and that's a relationship, I think, that's effective.

Q94 Lord Lewis of Newnham: But let's say the consumer is a farmer, let's take it one step back. How do you get this information through to the farmer?

Professor Oldroyd: Well, the way that we deliver to farmers is through the plant-breeding companies and the biotech companies, because we're not going to hand seeds to farmers. It's going to be the private companies who ultimately sell their seed to the farmers and it's those companies who decide to invest, take up some of our scientific discoveries or to work alongside us. So from our perspective, right at the base of that chain as the fundamental researchers, I think the thing that's closest to my heart is making that chain work between the fundamental research to the corporations, the biotech companies and the plant-breeding industry. I think at least here in the UK—I don't think it's true in other parts of the world—there is a real gap in the investment in that translation from fundamental discovery to application in the companies. And it's that willingness to take an initial discovery made in the lab to something that the companies are willing to take on. The companies will not jump in. If I clone a gene that's important, say, for nitrogen fixation in legumes, a company is not going to jump in and invest a huge amount of money, because I have to prove—take it to quite a high degree of proof—that that will have application in a crop, and there's a gap there in taking a fundamental discovery in my own lab through to something that is proven to be translatable.

Q95 Lord Lewis of Newnham: And who sponsors that individual, that intermediate step?

Professor Oldroyd: Well, at the moment, I think it has to be a combining of public and private investment and, for instance, the LINK scheme was very effective. It was well liked by the researchers and it was well liked by the companies. And we've seen a shift from LINK to TSB and, in our experience, TSB has been very slow to respond to the agricultural sector and it's been very poor, as a whole. It's done virtually nothing in the agricultural sector until the last 12 months. So maybe I'm being a little unfair and that will change and suddenly it will move. They are moving into the agricultural sector, but it's been very slow to do so.

Q96 Lord Cameron of Dillington: Sorry, you've lost me. What is TSB?

Professor Oldroyd: Technology Strategy Board. What was BBSRC support for translational research that used to be in LINK has been now usurped into TSB. But what we haven't seen is TSB taking on the agricultural sector, whereas LINK was great, because again, it was very responsive. I have a specific issue in my lab, I see a translation, I get a company that's interested, the company is willing to put a bit of money in, the public sector is willing to put some money in and we can go relatively quickly. With TSB, we have to wait for TSB to decide that my area of research is of significance and create a call. That could be years away, so it lacks a responsiveness and effectiveness.

Lord Lewis of Newnham: Well, thank you very much. I hadn't heard this criticism of TSB, but I can well imagine it to be true, yes.

Q97 The Chairman: Have you had any experience with the two schemes—the old case studentships and what used to be called the Teaching Company Scheme, which became the Knowledge Exchange Networks or Knowledge Transfer Networks, or something like that?

Professor Oldroyd: Right. So the case studentships we continue with. We do have case studentships and, for John Innes, most of the case studentships are supported by the plant breeding sector. It's an unfortunate reality that we often get more case studentships that we can fill. We often get offered more case studentships by BBSRC than we have companies willing to put the money in, and that's just a reality of the agricultural sector at the moment in the UK. I suspect that would not be the case in, say, America where there are much larger corporations engaged in the agricultural environment, but in the UK—

Q98 The Chairman: It tends to be the larger companies, of course, who take up the case studentships.

Professor Oldroyd: The entire UK plant breeding sector has only a couple of million to put into R&D. That's a pittance, really, for most sectors. Something like a case studentship is actually a genuine investment for them. And that's true also for things like the LINK. So we're increasingly encouraged to do industrial partnership awards or case studentships to get the industry on side to get the research funds and there is not the strength of an agricultural industry in the UK to really engage fully to the level that we would like them to.

Q99 Baroness Howarth of Breckland: I think before we move on to the questions that I want to ask, I just want to go back to something you said a few moments ago and rather challenge you on it, in that you said the consumer who was going to eat the food is not really your responsibility; you have a series of consumers in between. But if we go back to the discussion we had about who ensures that consumers understand the nature of

technology and are therefore not, if you like, turned off like the GM debate about it, do you not have a role somewhere in that as institutes?

Professor Oldroyd: I agree with you, and perhaps I was being a little bit extreme in that view, but undoubtedly it's the scientist's role to explain the science to the end-consumer, which is the people who eat the food, and that's not been a hugely successful approach, at least in the last decade, but I hope that we're turning that around. We'll see.

Baroness Howarth of Breckland: But you have had bits of success, broccoli and—

Professor Oldroyd: We have.

Q100 Baroness Howarth of Breckland: Why can't you learn from those experiences and get the end-user more engaged?

Professor Oldroyd: It's interesting. When John Innes did the purple tomato that has high degrees of anthocyanin, which has been proven to be effective against cancer, it was the first time that we had a huge positive response. Our communications department was inundated with very positive responses from the public, who actually wanted us to send them seed of these tomatoes, even though they were GM. So I think that, yes, clearly there are examples where we can engage very proactively in that area with the general public, and there are many people, including myself, at the institute who are very actively engaged in that process of communicating to the public.

Q101 Baroness Howarth of Breckland: That is the same issue as the question I want to ask about the farmers of tomorrow. Farmers are like the rest of us, pretty ordinary folk. They'll need to be equipped with more technical and managerial skills than they've had in the past in order to engage in modern society, and we understand that the JIC is actively engaged in providing aspects of such training. Can you tell us a little bit about what the JIC is doing and who else is involved? And do the same considerations apply in the UK as elsewhere in the EU?

Professor Oldroyd: I'll just step back a little bit first on that question. Reading the paperwork, it seems that there's a view that farmers are slow to take up new technologies. In my experience, that's not the case and we have lots of events with farmers coming directly to the JIC and we hear only enthusiasm for the work that we're doing. Really the farmers are saying, "When can we have this? When can we have the seeds that do this?"—fixed nitrogen or blight-resistant potatoes and so on. So the farmers tend to be extremely enthusiastic, and generally when it comes to genetic improvements, whether that's through plant breeding or through GM, it doesn't require a huge step change in what the farmers do, because it's entrained within the seed, that the seed will deliver whatever the change is supposed to do.

So, I think the farmers are extremely enthusiastic to take up innovation in genetics. In fact, we've seen year-on-year improvements in yields every year and a lot of that is driven by improvements in genetics, delivering new varieties to farmers and farmers using those new varieties. So I don't think farmers are slow, at least in this area, in the uptake of innovation.

On the training of farmers, as I said, we as an institute are involved in putting together a new course on agricultural sciences. That's a joined-up course between the John Innes Centre, the University of East Anglia and Easton College. Easton College are more traditionally associated with teaching the processes of farming and we are at the fundamental research end, but we're trying to join that together into an undergraduate course. I think that that's an exciting development, where farmers will be trained in understanding the genetics and the

potential in the basic research all the way through to managing a farm; I think that's quite exciting.

Q102 Baroness Howarth of Breckland: How do you think we're doing in relation to the EU in comparison to others?

Professor Oldroyd: In training in that area? I don't think I'm in a strong position to answer that question. I would say though that it's very important to be internationally competitive. Science is a global process and we rely very heavily on non-UK and non-EU nationals to fill the jobs, the post-docs, the graduate students. I did my PhD at Berkeley in California. I did a post-doc at Stanford in California. I benefited very much from training abroad. I came back to the UK and have taken my research forward, and I saw when I was in California that the biotech and high-tech industry was driven not by Americans but by immigrants, particularly from India and from China. They were benefiting immensely from essentially being the brain drain, taking the top leading scientists in the world who have been educated abroad, bringing them to their country and driving their own economies, and I think the move in limiting visas is going to really create problems for us and the scientists.

Baroness Howarth of Breckland: That's an important point.

Professor Oldroyd: And I think that science is a global system and I think it's very important that we maintain our international competition.

Q103 Lord Lewis of Newnham: You were talking about courses, which I believe you say are undergraduate, postgraduate courses, so these are the undergraduate or the three-year course or something of that particular nature?

Professor Oldroyd: Yes.

Lord Lewis of Newnham: Isn't there a hope or an aim to get shorter courses, say three-month courses, where people who perhaps have been in an experience can come back or is that something that you would want to hand on to another—

Professor Oldroyd: I got drawn off into my own thinking, but there are a number of other areas where we at John Innes are involved. We have put an application in for the ATP, which is a training programme run out of BBSRC. It would be exactly that—short summer courses. We have a training suite at the institute, providing short summer courses, a month or two months, particularly for the industrial sector, to bring people in, train them in areas of understanding of plant genetics and so on, and for graduate students. It's sort of the equivalent, if you're aware of the Cold Spring Harbor type courses, which are these short summer courses that bring in people from different sectors.

We also do a Masters course in plant genetics, in plant-breeding and we also have a teacher science network that brings scientists from the John Innes Centre into the schools in Norfolk that engages directly with students in the schools at all levels.

Lord Lewis of Newnham: Thank you very much indeed.

Q104 Baroness Howarth of Breckland: May I just finish with one last point. You quickly said the visa issue is going to cause problems. Could you just say what impact that is going to have on innovation?

Professor Oldroyd: Very significant at the moment, because we take in a lot of non-EU nationals and we are allowed, at the moment, 10 for the year and that is a fraction of what we would normally take in.

Lord Lewis of Newnham: What would you normally take?

Professor Oldroyd: I am not aware of the exact numbers per year.

The Chairman: You could let us know.

Professor Oldroyd: But I can let you know. But it's significantly more than that, and it means that we will have to take second-rate candidates, not the top candidates, because we don't have the visas to offer to them.

Q105 The Chairman: Have you written to the Secretary of State at BIS?

Professor Oldroyd: We have, yes.

The Chairman: Because I know that he is anxious to be given individual cases that he can actually use and argue with the Home Office. It's a very live issue at the moment, as you probably realise.

Professor Oldroyd: It's unfortunate.

The Chairman: And we've had a number of short debates in the House here about it.

Professor Oldroyd: Yes, so we have written a letter. But I just add, it's unfortunate it seems that football is worth an international status and science is not.

The Chairman: Don't worry, this point has been made many a time, so we're with you.

Q106 Earl Caithness: Can I quickly go back to a reply that you gave to Lord Cameron when you were talking about the constraints the EU put on you when you're doing your research? Do you think that the constraints that the EU put on are worse for agricultural than for, say, pharmaceutical, our other industries, or is the whole blanket approach of the EU being far too bureaucratic?

Professor Oldroyd: No, I think it's a blanket approach that the EU is being far too bureaucratic, but I will say that generally the EU very, very strongly requires SMEs to be part of the research programme, and that's fantastic for the medical sciences, because there are thousands of SMEs in Europe that are willing to put a small amount of money. In the agricultural sciences, they just don't exist. And so something that worked in one sector doesn't always work very well in another. Yes, there are some SMEs, but there's just not the number that there are in the pharmaceutical sciences.

But the other side of that coin is that when you look at the total investment, for somebody in the medical sciences, they can go to the Medical Research Council, they can go to the BBSRC, they can go to Wellcome, they can go to Cancer Research UK, they can go to the EU, they can go to any number of other charitable bodies. As a plant scientist, I am very limited. Only a fraction of BBSRC money goes into agricultural sciences. There are no charitable bodies that support my research.

There is the Gatsby Foundation. It's fantastic. It's Lord Sainsbury's charitable arm. It's putting very valuable money into plant sciences, but it's not generally open to any scientist to approach. I have a student currently funded by them, but I can't just go in with an idea and say, "Can you fund this idea?" So in the agricultural sector, we are basically BBSRC or EU, and that's essentially our only options, whereas the medical sciences can choose a much broader swathe.

The Chairman: Thank you very much, and I'm sorry to have kept you quite so long.

Professor Oldroyd: That's fine.

Agriculture and Horticulture Development Board (AHDB) F F and the John Innes Centre

The Chairman: It's been extremely valuable for us and many thanks indeed for coming.

Supplementary written evidence from the John Innes Centre (IEUA 32)

Border and Immigration – The John Innes Centre and The Sainsbury Lab Tier 1 & 2 and Work Permits on Site

JIC currently has 2 Tier 1 science related staff on site. Tier 1 relates to staff who have the responsibility to obtain their own visa. Both of these visas expire in 2012.

JIC currently has 20 Tier 2 science related staff on site. Tier 2 is where JIC is required to issue a Certificate of Sponsorship to individuals coming to work here in order for them to obtain their visa.

In addition to Tier 2, JIC currently has 13 science related staff who have work permits.

In total JIC has 33 staff on site who have required visas/work permits to work here.

The countries the 33 staff have originated from are:

India	Vietnam	Japan
Russia	Israel	Ukraine
China	Australia	
Korea	USA	
Mexico	Romania	
Canada	Croatia	

At TSL there are 13 people affected who are employed; those who applied prior to Nov 2008 are on the old work permit (2); 2 academic visitors; 3 employees on transitional arrangement; 1 Turkish visa extension; and the remaining are on the Certificates of Sponsorship. The employed posts are normally for 3 years and then we may extend them. The academic visitors are only allowed to be here for 12 months. We have an Indian Fellow who is on a 12 month fellowship, but we have a Japanese Fellow who will have to return to Japan to extend his visa, as his fellowship is for 24 months, but we were unable to obtain tier 5 sponsorship for him.

Period of Visa

The term for these staff varies. Most staff are here for 3 years. However, they can come here for a maximum of 4 years on a Tier 2 – there's no minimum amount of time.

The latest visa expiry is May 2013. However, the duration of the post is sometimes longer than the visa date. In this situation JIC will have to apply for an extension. If an individual receives an indefinite contract (e.g. tenure) the individual has to apply for indefinite leave to remain when they have accumulated 5 years employment history.

The Japanese Fellow at TSL may not be able to complete his full fellowship if his visa extension is rejected. In addition one academic visitor only got a visa for 6 months and he had to apply for the additional 6 months whilst he was here. He was successful with this though, but again incurred additional costs and we incurred additional man hours to support him. The post-docs who are on Tier 2 visas may apply for fellowships whilst they are here, but we are unable to put them onto Tier 5.

Independent Fellowships - Researchers We Have Rejected

One of the JIC PLs had a Researcher who would have had to have a Tier 5 – however the PL has since taken a post at Oxford University. The university would have been able to provide a Tier 5 under their allocation.

Another JIC PL had a New Zealander wanting to come for a 36 month post. The only way JIC could have accommodated this was if the researcher came for year 1 as an academic visitor, then went back to New Zealand for year 2 and came back here for year 3. The individual decided not to come.

JIC and TSL each have a Japanese postdoctoral Fellow coming on a JSPS postdoctoral fellowship in March 2012. Currently we have no mechanism to enable them to come under Tier 5. If this is not resolved these two highly prestigious fellows will not be able to come and work at JIC or TSL.

Additional Information

SSC RCUK are looking at this on behalf of BBSRC for Tier 5. We will be included in this. Non SSC Institutes will probably have a charging system.

Independent Fellows come under Tier 5 not Tier 2 as their job would not have been advertised and we are not paying them so they would not be on JIC or TSL terms and conditions.

JIC and TSL Visa Breakdown

John Innes Centre

Tier 1 visa (staff who have responsibility to obtain their own visa)	2
Tier 2 (JIC is required to issue Certificate of Sponsorship)	20
Work permits	13
Total	35

Countries of origin:

Australia	Canada	China
Croatia	India	Israel
Korea	Japan	Mexico
Romania	Russia	Ukraine
USA	Vietnam	

The Sainsbury Laboratory

Tier 1 visa (staff who have responsibility to obtain their own visa)	1
Tier 2 (TSL is required to issue Certificate of Sponsorship)	2
Work permits	2
Academic Visas	2
Transitional Visas	3
Turkish Visa Extension	1
Tier 5	1
Total	12

Countries of origin:

Argentina	Canada	Columbia
India	Japan	New Zealand
Turkey	USA	

John Innes Centre/The Sainsbury Lab HR
25th November 2010

Rothamsted Research

Written evidence (IEUA 17)

I. The Institute

Rothamsted Research (RRes) is a BBSRC institute. It is the largest institute in the UK conducting world-class scientific research of relevance to crop-based agriculture and the environment. It has been a major contributor to innovation in agriculture since its inception with the development of inorganic fertilizers, by John Bennett Lawes through to the creation of pyrethroid insecticides (Prof. Michael Elliott) and the elucidation of the nitrogen assimilation pathway in plants (Profs. Miflin and Lea).

Rothamsted Research has five research Centres (see: www.rothamsted.bbsrc.ac.uk/Research/Centres), all making major contributions to innovation in agriculture in the UK, Europe and worldwide through international collaborations.

- The **Centre for Crop Genetic Improvement** aims to elucidate underlying mechanisms determining resource use, and to develop novel strategies for crop improvement with an emphasis on traits that impact on sustainability. RRes is involved in the Wheat Genetic Improvement Network (www.wgin.org.uk) and the Oil Seed Rape Genetic Improvement Network (www.oregin.info), which aim to achieving improvement in sustainability through crop genetic improvement, to generate pre-breeding material carrying novel traits for the UK breeding companies and to deliver accessible technologies, thereby ensuring the means are available to produce new, improved varieties. Within these networks there is a focus on dissemination of information and genetic resources for the benefit of the stakeholders.
- The **Centre for Soils and Ecosystem Function** performs cutting-edge research to predict and manipulate processes affecting soil and ecosystem functions, productivity and resilience by understanding biotic and abiotic interactions that occur within soil, and between above and below ground ecosystem components, from the molecular to the community level. This research provides the innovation upon which more sustainable agricultural methods may be developed and implemented. This is particularly important as we move towards the reduction of chemical use in agriculture. Soil health and the provision of “ecological services” (many of which are of great economic value) are essential to long-term agricultural sustainability and productivity. Innovation in these areas will be essential to the sustainability of EU agriculture over the next 30 years.
- The **Centre for Sustainable Pest and Disease Management** focuses its research on impeding the emergence of new variants of pests and diseases. Our scientists are experts on the molecular basis of pesticide mode of action and most importantly the mechanisms by which pests evolve resistance to pesticides and genetic tolerance which is bred into many crop plants. Breakdown of this tolerance due to the evolution of the pests costs hundreds of millions of pounds annually in the EU alone.

- The **Centre for Bioenergy and Climate Change** aims to understand and predict the likely impacts of climate change on biotic and abiotic components of agro-ecosystems and provide land-based solutions for mitigation and adaptation through carbon-neutral renewable bioenergy crops and sustainable management strategies that retain ecosystem functions and reduce greenhouse gas emissions. It also innovates through the introduction of novel crops and land use strategies.
- **Centre for Mathematical and Computational Biology** has major strengths in biomathematics and modelling, which it is using to develop and apply predictive models of biological systems and their interactions with the environment at multiple biological scales. Rothamsted's long-term "classical" experiments, Insect Survey databases and participation in the UK Environmental Change Network provide a unique resource for studying the impact of environmental change on the biodiversity of managed land. In recent years, this group has published widely on the potentially dramatic impact of climate change on agricultural productivity in the EU. The biomathematics group also houses a strong capability in bioinformatics, which provides our interface between high-throughput multi-genomic sequencing ('systems biology') and the science of plant genetics and breeding.

In addition to the "Centres", Rothamsted also has two satellite campuses:

- The **North Wyke Research Station** Devon joined Rothamsted Research in April, 2009 and focuses on hydrology and ecology at a systems scale, enabling us to study the impacts of environmental change on a wide range of managed land-based systems; arable and pastoral.
- **Broom's Barn** is the **Applied Crop Sciences** department of RRes, based in the east of England, which acts as a link between research and the arable industry; focussing particularly on sugar beet production.

General Comments on the inquiry

With regard to crop protection a "perfect storm" is brewing in EU agriculture. Legislation is reducing the number of pesticides available to farmers long before there has been sufficient research into effective alternatives. This will inevitably lead to increased selection pressure for pest resistance to the remaining pesticides as their use increases. This means that EU agriculture is especially vulnerable to future outbreaks of highly-resistant pests compared to most of our trading partners. Globally, there are long term trends: population increase, changing diet, competition for agricultural land (exacerbated by biofuels development) and climate change to which we are obliged to respond. It is crucial that food production increases to meet demand without attendant loss of quality, which is at great risk as pesticide use is curtailed. With respect to crop protection, the EU is currently going in the opposite direction than the rest of the world and may have to contend with reduced agricultural yields. There is therefore an urgent need for research into alternative crop protection techniques that will provide the effective control of pests that we have achieved traditionally through chemical pesticides. In addition, research on the development of resistance mechanisms will be an important part of innovation towards new, safer agricultural chemicals or biological control methods.

The disjunction between restrictive regulation in the EU and the lack of resources for agricultural research and innovation is probably the biggest threat to the long-term viability and competitiveness of EU agriculture. As we have seen for the last 12 years, the EU regulatory framework on GM technology has resulted in a loss of billions of euros in

investment in research and innovation, much of which has moved to the USA and elsewhere (Syngenta, BASF, and Monsanto). This has inevitably caused a loss of highly-skilled personnel from Europe to the US and Canada. Most importantly, European agriculture is still dependent on 20th century methods of agricultural cultivation with stagnant or declining yields, while many parts of the world are enjoying a renaissance in agricultural production and improved farm ecosystems due to no-till agriculture and massive reductions in pesticide use.

The international adoption of various GM technologies is summarized in the following document:

<http://www.isaaa.org/resources/publications/briefs/41/executivesummary/default.asp>

As the EU moves towards tighter regulation of agricultural chemicals, there has been no counter-initiative to expand research which will find substitute agricultural methods for those which will be lost. This systemic inconsistency between regulation and investment in innovation is the most serious threat to sustainability and competitiveness of EU-based agriculture.

Evidence from Rothamsted Research

(Responses are from several senior scientists at Rothamsted Research and compiled and edited by Professor Maurice Moloney, Director and Chief Executive)

2. Responses to the consultation questions

Definition of “innovation” in the agricultural context

1. We have outlined above how we currently perceive “innovation” in the agricultural context, but we would welcome views on your interpretation of innovation in the agricultural sector.

Innovation in agriculture needs to be understood in a more holistic sense. It is true that we need innovation in biotechnology, novel crops and germplasm and machinery or cultivation methods, however, innovation in the manipulation of soils and ecosystems to support long-term sustainability should also be encompassed by this definition.

Innovation in EU agriculture as a strategic objective

2. The EU believes that innovation and knowledge are key to the EU’s economic growth and that all sectors should play their part. Do you agree that innovation in EU agriculture should therefore be pro-actively encouraged? Alternatively, do you see agriculture as a distinct sector faced with particular challenges to which the sector will inevitably react in an innovative manner?

2.i We agree that all sectors should innovate and that innovation in EU agriculture should be pro-actively encouraged by both public and private (industry) funding and general support (e.g. through education, training and career structures). However, agriculture is a distinct sector in that it produces food, which along with water is the most fundamental prerequisite to life and civilization. In addition, it is uniquely affected by global change, rising populations and developing economies, and in itself, shapes the wider environment and other forms of ecosystem services. Agricultural innovation is therefore an essential activity for life itself and for quality of life. It therefore deserves special attention and focus.

Agriculture has always relied on innovation from the first humans who created cultivation and selection, via Mendel who described the basis on which genetic selection depends, through to the present day where the use of whole genome sequencing permits precise modification and selection of genotypes to improve plant and animal agriculture. However, agriculture is never static. There are always immense pressures on the system due to weather and climate, pests and disease, supply and demand, international trade and distribution, input costs and profitability and the need for quality as well as quantity.

The research community routinely offers approaches in response to all these pressures, but support for research and innovation has been frequently neglected in favour of more “industrial” innovation (**e.g.** manufacturing, IT, pharmaceuticals) until we are alerted by a crisis in supply or commodity prices as happened in 2007. Unfortunately, the timescales for innovation in agriculture are too long to rely only on **re-active innovation**. It takes 7-10 years to obtain approval for a new variety of conventional wheat, much longer for a biotechnology-based crop and so the re-active model is unable to provide solutions fast enough. For this reason for our own security, we need to be committed to pro-active long-term research and innovation in agriculture and policy and regulation should be based solidly on a scientific foundation generated by this ongoing investment by society.

2.ii Farming is a distributed activity and not amenable to the kind of economies of scale that derive from concentration in other businesses. Thus we cannot concentrate food production in a large factory in a major city as we might for industrial production. Neither is farming an activity like mining even though it produces raw materials for industry. Mining continues until the resource is depleted and then the industry moves elsewhere. In contrast, agricultural land is a long-term, hopefully permanent resource, which must be maintained and ameliorated through agricultural practice. Innovation must take into account this spatial constraint and must be distributed to meet the unique needs of each geography and environment.

2. iii One of the greatest costs to society in the developed world is health-care. Health-care has unfortunately been pigeonholed as curative medicine (which is very lucrative to pharma companies and costly to society), but in fact our wisest investment should be in **preventative medicine**. Good quality nutrition is the most fundamental form of preventative medicine and this can only be provided by rigorously-managed agriculture. There is enormous scope for innovation in this sector, which could result in dramatic reductions in very costly diseases such as diabetes, cardiovascular disorders, gastrointestinal problems and even dementia. Each of these conditions cost tens of billions of euros per annum in Europe alone, where type II diabetes alone afflicts almost 20 million people. The scope for reducing healthcare costs through investment in high quality raw materials for food is enormous and the return on investment would be huge, however, it has been difficult to convince the Commission of the importance of prevention, despite the clear evidence of economic savings resulting from anti-smoking campaigns, increased dietary fibre consumption and vaccinations. Innovation in agriculture and processing agricultural products can deliver comparable savings in healthcare costs, for a fraction of the cost of pharmacological intervention.

Innovation today

3. How is EU agriculture innovating now? Can you explain under what conditions the agricultural sector is best placed to innovate? Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?

3.i The EU is innovating now by developing new plant varieties for improved nutrient use efficiency (see WGIN and OREGIN notes above), drought tolerance and pest and disease resistance. Other innovations include breeding improved farm animals for better quality and reduced carbon footprint, developing new machinery, developing precision agriculture using GPS and remote sensing. The application of the molecular techniques of genome and transcript sequencing is crucial to the rapid development of new germplasm for variety development in major crops, and also in the understanding soil biodiversity and its function for sustainable agriculture.

3.ii Innovation is probably currently stimulated by pressures such as Climate Change, Food Security and economics (i.e. the need to maintain profitability). An artificially secure agricultural sector, e.g. one protected by subsidies, becomes complacent. In contrast, security of funding for research and innovation is necessary to attract innovators to work in the agricultural sector rather than in other less-critical areas.

3.iii We are reaching the point where, in the UK, innovative capacity is being lost in some areas, such as soil and water management and practical agronomy. This puts at risk the entire innovation agenda in agriculture, because virtually all of the solutions for the challenges to agriculture are multi-disciplinary.

3.iv Much of the upcoming agricultural policy from the EU and the UK is not informed by scientific research, but rather by NGO pressures and activist group campaigns. This will result in a reduction of production. The policies have been formulated based on the idea of “environmental benefits”, however these purported environmental benefits have not been quantitatively evaluated by researchers. Unfortunately, when they are properly evaluated, we shall undoubtedly discover counter-intuitive aspects where the unintended consequences of well-meaning legislation puts at risk both production and the environment.

Obstacles to innovation

4. What are the current obstacles to innovation? Is there a shortfall in research capacity and in technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their businesses?

4.i Agricultural research, in the UK at least, has suffered from reductions in funding for many years, especially in strategic and applied research. The UK's Royal Agricultural Society of England (RASE) has commissioned reports on this, see for example:
http://www.rase.org.uk/news-and-media/latest-news/PwS_Ag_Research_report.pdf

4.ii There is a shortfall in research capacity in some areas, especially soil and water research and other strategic areas, more so than in basic bioscience; the emphasis on biology has also

led to a dearth of mathematicians, chemists and physicists. There is an even greater problem in succession, with an ageing (50+) cohort of agricultural research scientists but few in the 30-40-year old age range except perhaps in plant sciences. There is a perceived absence of career prospects, and also fewer degree-level courses in appropriate disciplines.

4.iii There is definitely a shortfall in research capacity and particularly in technology transfer specialists. The extension service that bridges and connects research with application has been lost in the UK. Much current research is not aimed at production. The dramatic increases in production since the 1950's came about because of research and implementation strategies that were government policy. Since government investment in production-orientated research has declined markedly so has the rate of yield increase of crops. Most major arable crops have now reached a yield plateau and will stay there unless major investment in production-orientated research and technology transfer.

4.iv IP rules can be a problem when trying to collaborate with industry. The acknowledged need for multidisciplinary science does not make for easy IP negotiations. However, funders such as the BBSRC in the UK are eager for its scientists to develop their IP and benefit from it. The BBSRC regularly runs courses to encourage IP development.

4.v The main obstacles to planting forests on agricultural land are the long return times before which profit is made. This could be altered, e.g. by an effective carbon trading system.

4.vi As argued above, the most effective disincentive to innovation in European agriculture is the lack of connection between EU regulations and the underpinning science. This is manifest in the EU's GM legislation which has been substantially discredited by the volumes of solid science emanating from every corner of the world, the new pesticide directives which fail to evaluate benefit alongside risk and the capricious invocation of the precautionary principle in response to innovation in agriculture and food. In order to re-establish vibrant innovation in the sector, it will be necessary for the EU Commission to show leadership and direction to ensure that our regulatory frameworks are based on peer-reviewed solid science rather than being heavily influenced by activist groups, who replace science with rhetoric.

Demographic structure of the sector

5. To what extent is the demographic structure of the sector (an ageing farming population) an obstacle to innovation; and, conversely, might greater innovation in agriculture serve to bring new recruits to the sector? What incentives currently exist to encourage young people to agriculture; what further efforts might be made?

5.i An ageing farming population is without doubt an obstacle. There are many examples of young farmers as dynamic innovators, who engage with and develop activities such as Open Farm Sunday, which is organised by LEAF (Linking Environment And Farming). In contrast, it can prove impossible to contact, let alone interest, older farmers in the innovations that research institutes such as Rothamsted develop. "Reaching the unreachable" is a constant challenge in UK agriculture with the loss of markets and the social structures that once brought farmers into regular contact with colleagues and the wider society. Added to this, the enormous amount of bureaucracy leaves farmers with little time to engage in innovation and knowledge transfer.

5.ii Innovation will not in and of itself bring in many new recruits, although younger farmers and growers will be much more open to new technologies and methods as long as they enhance returns on their investment. A more positive perception of agriculture as a career is needed. For many, this will mean an opportunity to enhance income through ingenuity and innovation, just as it is in more urban business. Agriculture needs open-minded, business-wise and innovative recruits to seize on innovations that exist and to challenge researchers to innovate more.

Future challenges driving innovation forward

6. Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

6.i The major challenge that will drive forward innovation in EU agriculture is the need to feed an increasing population. Europe under climate change will be a major global food producer – so there will be great opportunity for export of food and food products. Currently we are implementing EU regulations that will reduce food production (mainly pesticide and water quality regulations). Research to increase production is urgently needed. Research institutes with an emphasis on production-orientated research will be critically important.

6.ii Innovation is also being driven by pest and disease resistance to chemical controls and the public dislike of “chemicals”, by Climate and wider Global Change, by a growing and richer world population that demands more food and particularly more protein, and by the need to increase food production without degrading natural ecosystem services. In recent years, the need to protect air and water from pollution, with such regulations as the Water Framework Directive and ammonia and greenhouse gas emission targets, have driven, and will continue to motivate innovation.

6.iii The response should be greater investment in agricultural research by governments and industry at institutes and universities and colleges with a proven track-record in innovation. Unfortunately, we see investment declining. The current economic crisis in the UK and the cuts threatened in the Comprehensive Spending Review (CSR) could result in the opposite of what is desperately needed.

6.iv There is a need to manage diverse expectations from different parts of society. Land must produce increasing amounts of affordable, safe nutritious food at the same time as delivering habitat for wildlife, recreation and buffering floods. At the same time there is increasing regulation, much of which obviates the potential for progress on these fronts.

6.v The overall challenge is as expressed in Sir David Baulcombe's report for the Royal Society “Reaping the Benefits: Science and the sustainable intensification of global agriculture” (see <http://royalsociety.org/Reapingthebenefits/>) and is that we need to intensify agricultural production and at the same time increase sustainability. This will create further and substantial pressure to deliver crop protection, i.e. management of pests, diseases and weeds, via the seed. Although breeding, and now molecular breeding, is very successful at this, there need to be completely new targets for improving pest, disease and weed

resistance. This will involve gene products, i.e. proteins, including enzymes that catalyse the biosynthesis of secondary metabolites, which will be identified by multidisciplinary studies under the overall subject Chemical Ecology. Thus, crop plants will need to be manipulated genetically, either by directed breeding or genetic engineering, to produce secondary metabolites acting against pests, diseases and weeds, preferably by non-toxic modes of action involving signalling, i.e. semiochemicals. In addition, this work will provide new plant activators, which are themselves natural products or close relatives acting only by signalling mechanisms, and which switch on not only defence but other processes associated with sustainable intensification.

Knowledge and innovation systems

7. Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

7.i The current formal funding structures of research councils, Defra, levy boards, etc, have been effective, although better collaboration by the funders would improve the effectiveness of research funding. However, Defra continues to reduce its funding for research and the research councils have moved away from funding strategic and applied research. This needs to be rectified.

7.ii Less formal organisations that link researchers to agronomists (i.e. advisers/extension officers) and farmers, such as the Rothamsted Research Association (www.rothra.org), are also vital for two-way knowledge exchange and stimulating innovation.

7.iii The systems required to support innovation in EU agriculture should involve closer collaboration between industry and researchers. Government needs to support this collaboration formally – and consistently. The recent TSB funding for work in Crop Protection seemed like a good idea, but the implementation of the funding was poor and as a ‘one-off’ call it does not work as a long term policy.

7.iv An important element in this is a full understanding of the food supply chain. Food security relies on every aspect of the supply chain from innovation at the level of germplasm and genetics right the way through to delivery of food and food products through retail outlets. It is unusual for all the members of the supply- (and value-) chain to meet and discuss priorities, but it will be essential to delivering efficient food security. Innovation will naturally arise out of these interactions.

Research and Development

8. Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

8.i The research agenda should be established through dialog between those who practice agriculture, those who fund the research and those who do the research. There has to be a balance between the “blue skies” innovative research that could provide novel solutions (but

probably in the long-term, 10-15 years plus) and applied and strategic research that is needed to resolve current problems such as better nutrient management, air and water pollution and pest and disease resistance. Funding should continue to be through research councils, government departments and levy boards. However, any reliance of research councils on Responsive Mode grants to deliver strategy is unwise. Better methods need to be found when a strategic problem is identified, such as the “Sand Pit” approach used by NERC and EPSRC. To some degree, past success in R&D, assessed through outcomes and impacts, is a good way of targeting future funding when resources are limited. In other words, look at an institute or universities’ effectiveness in agricultural innovation through time. The requirement to predict outcomes and impacts when bidding for future funding is dubious and tends to result in much guesswork.

8.ii The research agenda must be established in close consultation with industry. More industry people need to be involved with planning and implementation of government schemes. The research should be jointly funded, and I believe industry is ready and able to collaborate with government research institutes, who are willing and able to interact with industry.

8.iii Distinct and complementary funding streams such as from MAFF (Defra) and research councils (AFRC/BBSRC) served the UK well in the past. However, years of cut-backs has led to dysfunction in the relationships of funding bodies. Inevitably there will be even less funding in the future. The different bodies need to be clear about their responsibilities and live up to them. The lack of continuity in funding develops into great uncertainty to the career prospects of individuals who tend to leave and find more secure employment in other fields.

8.iv Research Council funding is currently less than adequate. To meet future challenges in agricultural production research funding needs to increase as documented in the Royal Society report and also in the House of Commons EFRA committee report, “Securing food supplies up to 2050: the challenges faced by the UK”, which states that there is an urgent need for more money to be spent on public-sector food and farming research in the UK. Funding could be better targeted so that resources go predominantly to funding basic research which has potential translational value.

8.v Interestingly, the concern about times of austerity and funding raises some profound questions. The UK government’s largest budgetary commitments are in four major categories: health, education, social welfare and benefits and defence*. These four areas account for almost 65% of Government expenditure*. On the other hand, even if **all** R and D spending from Government were curtailed, the saving to the exchequer would be modest and certainly less than 2.5%*. Clearly, it would be unwise to eliminate **all** R and D expenditure but a cut of 20% would only benefit the Exchequer by a fraction of a percentage point. For that saving, we could be abandoning our ability to meet the food security and food quality objectives (along with many other areas of innovation) and denying the taxpayer any of these benefits and long-term savings. In consequence, responding to austerity measures by reduction in strategic investments in research and innovation is a major and avoidable mistake. It is a mistake that was made in the period 1979-1986 and resulted in huge losses in research and innovation, scientific talent (through emigration) and ultimately explains the loss of industries and revenue from the UK to companies in North America many of which were led by émigré British and European scientists.

* Data derived from:

<http://www.guardian.co.uk/business/interactive/2009/sep/16/public-spending-larry-elliott>

Education and skills

9. What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

9.i In the UK, the state of education and skills provision in agriculture is good at the post-graduate and post-doctoral level. By contrast, teaching of agriculture in schools is deficient – to-poor and generally inadequate at college and degree level except for Universities and colleges with a faculty or school of Agriculture. A few agricultural colleges remain (e.g. Harper Adams; the Royal agricultural College) which offer effective practical training, but most agricultural colleges and degree level courses have gone. The RASE is working with BBSRC to investigate needs in this area. The BBSRC is developing an Agricultural training programme that will meet some needs, but probably only at postgraduate level.

9.ii Currently there are too few practically trained scientists in agriculture. Research funding in recent years has driven research into molecular/genomics type research which is an essential scientific foundation for modern agricultural genetics. However, the complementary skills of agronomy, plant pathology, soil science, pest management, hydrology, taxonomy and agricultural ecology have been de-emphasized and under-funded. More training/funding of agricultural production systems and research on crop species (Wheat, maize, oilseed rape etc) is needed, in order to translate the UK's excellent science in model species such as *Arabidopsis* into useful agricultural traits in our major crop species: wheat, barley, oats, oilseed rape and sugar beet. This translational research will lead to ground-breaking discovery, but will also have major economic impact in UK agriculture and ag-products.

9.iii It is often difficult to recruit research staff in agriculture within the UK. The area is not seen as attractive for many of the reasons outlined above including overall funding levels and it is difficult to find UK graduates wishing to develop a research career in agricultural sciences. This certainly has a negative impact on the culture of innovation in agricultural science.

9.iv In addition to obvious needs in terms of educating students for careers related to agriculture and food production, the UK lacks focus in key strategic areas including chemical ecology where for example Germany has an entire Max Planck Institute devoted to Chemical Ecology. The US also expends significant resources in this direction, and yet no university courses on Chemical Ecology exist and only fragments of this important underpinning multidisciplinary subject are taught in the UK.

Other areas in need of more strategic focus include: systems biology applied to our key agricultural crops, mathematical biology and modelling, molecular ecology and bioenergy through agricultural means.

Knowledge transfer

10. How should research be translated into technology transfer and advice to practitioners? What are the respective roles, for example, of professional advisers, professional organisations, peer groups and the public sector?

10.i Some innovations and, more importantly some innovators, are capable of technology transfer and knowledge exchange. In many cases, however, a professional adviser and/or a professional organisation are essential. Here again in the UK, many advisers are aged 50+ and few younger people see this as an acceptable let alone lucrative career. Peer group knowledge transfer can be very effective: the innovative farmer with neighbours that “look over the hedge” can be a great source of knowledge transfer. The public sector, e.g., Defra, can be effective. For example, Defra funds workshops to launch and promote its new “Fertiliser manual (RB209)”. But such activities reach a limited audience. As noted above, “reaching the unreachable”, i.e. farmers in remote locations or who are too busy to attend public workshops, are a real challenge.

10.ii Researchers need specialist training in knowledge transfer. This is a highly specialised skill that few people have. Many researchers cannot translate their findings into practical farming systems. Partly because they are not closely linked with the industry, partly because they do not have the “systems” skills and knowledge transfer skills necessary. Some of this can be overcome by training and some by better collaboration with industry.

One of the most important areas of liaison is between researchers and private sector professional agricultural advisors, who provide services for a large percentage of UK farms. This relationship needs to be encouraged and strengthened, because it is the major vehicle for “extension agriculture” in the UK. Good researchers should have close links with industry, professional organisations and especially with these professional advisers.

EU policies

11. What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

11.i The CAP could stimulate innovation but, in its current form, seems to be more focused on rules for controlling the basic activities of farmers and payments. Some CAP rules, such as “Set-Aside” have stimulated R&D, in this case to study how it could be best used, e.g. for farmland birds. Currently, the CAP is more likely to stifle innovation, because it masks key market forces in relation to international commodity prices, productivity and competitiveness. Further exposure of EU farmers to the pressures of the international market will result in a desire for more efficiency and productivity, which will in turn cause farmers to demand innovation from agricultural sciences.

11.ii Current EU research policy is not currently helpful in resolving the issues above. There is currently an imbalance of emphasis on environmental protection at the expense of food security and we sense unnecessary tensions between the Environment and Agricultural Directorate. A more balanced approach would emphasize environmental sustainability in support of efficient production. Food production needs to be at the heart of EU policy. Currently, the EU is too inward looking in terms of “food security”. EU policy needs to consider the global impact of reducing food production within Europe at a time when we are struggling to feed a growing global population.

11.iii EU research policy and the Framework Programme should certainly stimulate innovation. However, recent programmes have not been as effective as they could be. One

of the problems appears to be the excessive focus on structure (how many countries represented) rather than function (the excellence and the potential of the research). Furthermore, as noted above there is an inappropriate imbalance, which fails to deliver the strategic objective of “environmental sustainability in support of efficient production”. Creating international networks is very desirable, but it must be done with the purpose of supporting the key objectives, not as an end in itself. Furthermore, large networks require strong leadership and management and this must be central to the planning.

II.iv Lower level public intervention is best focused on regional issues.

II.v In addition to generic points on EU policies that can be made by the Institute, it must be emphasised that the EU is not spending its research budget as effectively as it could. Without a significant overhaul it is unlikely to stimulate new and innovative research with much needed impacts on the sustainable intensification of agriculture.

24 September 2010

Oral evidence, 17 November 2010, Q 107-143

Evidence Session No. 3. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witness

Witness: **Professor Maurice Moloney**, [Director and Chief Executive, Rothamsted Research Institute].

Q107 The Chairman: Professor Moloney, good morning and welcome. Thank you for your excellent paper which we all enjoyed reading. I shall deal with the formalities first of all. I think you have in front of you a list of interests that have been declared by Committee members. This is a formal evidence-taking session of the Sub-Committee. We take a full shorthand note. That will go on the public record and on the parliamentary website. Obviously we will send you a copy of the transcript and you will be able to revise it in terms of minor errors. The session is being recorded and being webcast live and will be available on the parliamentary website subsequently. It would be helpful if you could state for the record your name and official title.

Professor Moloney: My name is Maurice Moloney and I am the director and chief executive at Rothamsted Research in Harpenden.

Q108 The Chairman: Thank you. I shall start with the first question. In paragraph 6.v, you say the overall challenge is that we need to intensify agricultural production and at the same time increase sustainability. You add further, in paragraph 7.iii, that the systems required to support innovation in EU agriculture should involve closer collaboration between industry and the researchers. There are three questions and I will give them

together. What specific areas of research should be targeted in order to deliver sustainable intensification of agriculture—that is, more yield and less input? What influence, if at all, do other sectors, such as industry, retailers and—what is particularly interesting—consumers have on the nature of the research undertaken? Finally, why hasn't there been better collaboration along the food chain, and how can that be encouraged?

Professor Moloney: Those are all very big questions and I will only be able to give you my glimpse of how we see it. I'll start with a little bit about the areas we believe should be targeted. Probably this Committee will be familiar with the report that the Royal Society came out with last year under the chairmanship of Sir David Baulcombe in which they argued quite strongly, based on very good scientific evidence, that the way forward on a global agriculture basis was a concept of intensification, with an eye on sustainability. The question is how you could possibly do both. The argument about intensification relates to the amount of arable land that is available worldwide. If anything, because of soil erosion and abuse of agricultural practices, and factors that we can't control, like climate change, there has been a reduction rather than an increase in available arable land. So, as we begin to look at our objectives for production, it is clear that we probably won't have any extra arable land to work with.

Having said that, there are many parts of the world where the intensification could be promoted by the incorporation of technologies which for us are fairly low-tech these days, but in parts of Africa, for example, they would be considered to be relatively high-tech.

We believe that in Western Europe we are part of the engine of innovation that can eventually export many ideas to the countries that will need them. We sustain ourselves, but will also help other people to meet these challenges. To answer the question specifically on what areas, I believe that in this country we need to increase and intensify our work on genetics and genomics. We have some world leadership in those areas already and we ought to maintain those while complementing that with bioinformatics—the concept being that we can generate a lot of information about the genetic makeup of crop plants, but you need the computing power and the ability to sift through these mounds of information to make sense of it. All of those things go together.

In very specific terms, there are areas of crop science that become very important, because we have a challenge of increasing the capability of our crop plants to produce.

Photosynthesis is one of the fundamental aspects of plant productivity. Again, the UK has a wonderful tradition of photosynthesis research, but we are in a new generation of what is possible because of the genetics and genomics work that's gone on. Things that we thought were not possible 20 years ago will now become possible. Photosynthesis research is an area where we believe that we can intervene effectively in a plant and increase its capability, fix CO₂ and turn it into useful food products.

We are going to face a challenge with nutrients and water availability. It might not feel like that in the UK when it rains a lot, but worldwide, water is going to become as much of a currency in agriculture as oil is in many aspects of our lives. Equally, many of the nutrients that we require to apply to plants are either in short supply or in limited supply. Phosphate is an example of something where there isn't a cycle of phosphate, so every time we apply phosphate to the soil, we are losing it to what the thermodynamic chemists would call entropy. In effect it's lost and costs a lot of energy to recoup it. Consequently, we need to make plants more efficient in the use of nutrients, otherwise we will have a crisis on our hands 20 or 30 years from now, when the cost of the inputs to maintain agriculture will be very, very high. We do believe those areas are important.

One other area that has been neglected for a variety of reasons is soil science. Soil science and what goes on below the ground tends to be a little bit ignored. I would also say that in the scientific community, we have things that go in and out of fashion a little bit. Unfortunately, soil science has not been in fashion as much as it ought to be. The quality of our soil is fundamental to our agricultural productivity. You can deplete soil by overproduction in a matter of five years. It could take you 25 years to get it back to the original state. Soil science is going to be a very important part of our ongoing research. Having said that, these are areas that have been highlighted in the UK as being of importance and value, but we need to maintain our efforts in that area.

The second question was about linking—

Q109 The Earl of Caithness: I wanted to come in on that, if I could, before we move on. You mentioned the research on photosynthesis and crop yield. Are you working at all with the people who are innovating in the other way, which is taking the chaff from the wheat and using the chaff for energy purposes, so when you are doing your research you're not suddenly going to cut off their market?

Professor Moloney: Yes, absolutely. One of the fantastic things about our focus now on bioenergy is that we take a bit more the approach that industries use. Manufacturing industry doesn't like to waste anything. Any waste product is a cost to the industry. In agriculture we haven't always done that. Now we are in a position to look at every "waste product", including the straw, and ask if there's value there and could we get better value out of it? Could we reduce the carbon footprint of the overall agricultural enterprise by doing these things? That's a critical part. It doesn't come naturally to everybody in the farming business, but we have to make these things attractive and interesting to the farming community as well.

Q110 Lord Lewis of Newnham: You have posed us quite a number of problems in your initial statements and I would like to touch on a number of them. Could I refer to bioenergy? How far are you seeing the conflict between growing crops for bioenergy purposes, as opposed to food purposes, and how far are you doing research into second or third generation systems for generating these fuels? Ethanol is a desirable product, but it has a very low carbon content as far as the fuel content is concerned.

Professor Moloney: There has obviously been a lot of controversy about whether we will end up competing with acreages for food purposes and bioenergy. There have been some microeconomic examples of that. If you look at the state of Iowa in the United States, where people built half a dozen bioethanol plants in a matter of five years, we began to see the cost of pig feed going up substantially because all of the corn was going off to them. It was a bit of a microeconomic thing, and I think on a larger scale, if we consider our history in Europe, where we have been capable of producing butter mountains, wine lakes and all those famous things in the 1970s and 80s, we have been capable of producing a lot more food than we need. We need to think about a managed system that allows us to do some bioenergy and maintain our food production. Food production is obviously paramount. Is it possible? We believe it is—and we believe not only that it is possible, but that there are ways of enhancing the environmental footprint and enhancing biodiversity by doing it. It is probably not by growing more wheat for bioenergy. That gives the farmer or grower the opportunity to hedge a little bit as to where the prices lie, but I do believe one of the keys to it is more cellulosic biomass. For example, in Rothamsted we have a programme on willows in short coppice rotations. That would be a very good example of a reproducible biomass which could become part of a supply chain to power stations or even to gasification plants that will

make fuels from that which can—generate electricity. The nice thing about cellulosic biomass of that nature is that you provide refugia for wildlife—small mammals, birds, insects—and at the same time, what you are doing between the shoots and the roots system, is sequestering an awful lot of carbon. We contribute to mitigating the overall carbon footprint of agriculture.

Q111 Lord Lewis of Newnham: But the use of algae recently has increased the amount of terpenoid content in your fuel, which is a much more effective agent for energy purposes than is diesel, making alcohol look like child's play.

Professor Moloney: I absolutely agree. We have a programme at Rothamsted to increase the terpenoid content of willows for precisely that purpose, because eventually, once that supply chain is there—and really that business doesn't exist in the UK yet—the calorific value per tonne of biomass will become a very important issue. I didn't realise there would be this level of technical detail available around the table—I'm very impressed.

Q112 Lord Giddens: Good morning. Could I say what a terrific submission you have made? I found it really compelling. I'd like to ask you how you define sustainability. The term appears everywhere in the environmental literature, but we have big problems with it, precisely because of the unknown factor of technological innovation in the future. You talk of the term quite a lot. Do you favour a narrow definition or a long-term definition? It's quite hard to pin down when it comes to any particular context of its use, and if you can't pin it down, then it loses most of its value.

Professor Moloney: We struggled more with that idea as we began to put together our new strategic plan at Rothamsted than with any other issue. Interestingly, in Sir David Baulcombe's report, most of the glossary has one-line definitions of most things. When you get to sustainability, it's about 15 lines. Everybody, even the most astute scientists, has a difficulty with it, too.

We have looked at it and said we are not talking about sustainability for the next 500 years. We are talking about a window in which we need to develop sustainability in relation to the kinds of pressures we know are going to happen on a worldwide basis. We are looking at 2050 and saying that that is a time when we know our agricultural output will have to have reached a level that is probably 70-100% greater than it is right now on a worldwide basis. If we were to use only conventional approaches now, we would have a lot of problems with sustainability. Consequently, within that period, we are going to have to find some aspects of mitigation. The sorts of things that we believe are very important are to integrate the scientific knowledge that has been generated from a lot of diverse areas. I don't know if you know much of my background, but I was involved in North America in a lot of the original work in GM technology. But I have no problem at all learning from the Soil Association or the organic farming movement if there are things that we can incorporate into our agriculture.

The kinds of things that we've been looking at at Rothamsted are first of all the importance of soil quality and our ability to maintain it without over-exposing that soil to additional inputs. A lot of that will be to do with the efficiency of the plant to use lower concentrations of nutrients that are applied to the soil. The importance of incorporation of organic matter into the soil is also going to be vital.

We then begin to look at alternative, possibly non-chemical, naturally occurring methods of pest control. We've had a long-standing programme by Professor John Pickett who's worked in the area of chemical ecology and has identified many systems that naturally occur in plants

that signal to insects. Essentially the signal is “I am not a host”, for this particular insect, therefore the insect doesn’t come along and act as a pest. If we can move some of those naturally occurring signals into our major crop plants, we have an opportunity to control insect pests and potentially fungal infections by chemical signalling. It took a lot of research to understand what kind of signals were moving, but if we can get those things working robustly, you could see a situation where you substantially reduce the chemical inputs that are necessary to sustain agriculture.

Q113 Lord Giddens: So you are essentially defining sustainability as food security, are you—would that be fair to say?

Professor Moloney: Food security and reproducibility. I believe that we have to be able to perform a particular agricultural practice year after year—notwithstanding the fact that we do rotations—and be able to come back and say we should be able to predict the output of this piece of land, based on the care we’ve taken of it and the fact that we have paid attention to all of the factors that are potentially deleterious.

The Chairman: This is incredibly interesting, but we also have a timetable to keep to.

Q114 Baroness Sharp of Guildford: I wanted to take you on from this to the other two questions that Lord Carter put to you. How far are you managing to get this message over to the industry, retailers and consumers, but also to Government? Do you feel this is a message that is being received and used?

Professor Moloney: Yes. At the level of industry, both the agribusiness companies and plant breeding companies and so on, we have very good communication and most of the interests are aligned. I’ll give you an example. I talked recently to BASF about our ongoing strategy and I said, “You’re probably not that interested in our sustainability research because there may not be an awful lot of profit in that”. In fact, they were wildly interested in it and they have a large group worrying about sustainability issues. The companies are definitely aligned in terms of the interests that we all have. Most of the big companies now believe that they cannot have a sustainable business unless they think about some of the aspects of sustainability at the farm level.

At the level of retailers, British retailers have become very influential in the supply chain over the last 10-15 years. Initially it’s been entirely self-interested in the question of how we ensure that we have appropriate supplies coming to our supermarkets. Now, because of consumer interest in the environment, in quality, in reliability, in provenance of food, all of those issues have now become important to the retailers. We have seen a lot more interest to discuss aspects of innovation technology, even at the level of Waitrose and Tesco and so on, which is fantastic.

The one additional issue is with the consumer. I have to say that, unfortunately, because of a legacy of 15 years of rather strident anti-technology propositions from a number of more ideological organisations, it has been very difficult to demystify the science associated with agricultural production. We’ve all heard it, that people say, “I will never eat food that’s got DNA in it”. Well, if that’s the case then where are you going to start? Clearly, we have a job to do in demystifying our science, because it isn’t sinister and in fact the whole history of agriculture—not the 20th and 21st century, but the whole history of agriculture—has been about innovation. It’s been observation and innovation.

Baroness Sharp of Guildford: And plant breeding.

Professor Moloney: And plant breeding and selection.

Q115 Lord Lewis of Newnham: One of the things I always find very amusing is the fact that many plants contain their own natural pesticides. The pesticide is not a novel concept within the plant world. Some of the manufacturing processes that one is using today are merely adapting what are natural pesticides within the plants themselves. How far are you? This seems to me to be a very critical path to follow, namely that if you take a pesticide in one plant that would cure it, by mixed farming as it were—is there very much of that going on and research into it?

Professor Moloney: There is definitely work on mixed farming going on. A lot of that work has been led by John Pickett's group and the approaches they've taken are very applicable to developing countries where essentially you now know the signals that pass between two plants and you can do co-cropping, and the signal that comes out of one plant will dissuade things like corn borers or even parasitic weeds like striga from devouring the corn crop. We've tried to use aspects like that in developing countries, because once you understand them, they're quite low-tech, you just have to plant the right things in the right order. It's a little bit of prescription farming, but not very high in expenses of inputs. On the other side of the coin, we are doing things such as having identified the wheat aphid alarm pheromone, John Pickett has moved that metabolic pathway into wheat and we will do a field trial probably starting at the end of next year, being winter wheat. It looks good in the greenhouse and the aphids don't like to go near this wheat plant because what they pick up is an alarm signal which says "I shouldn't be here". It's just a terpenoid-signalling molecule. That's the kind of thing that we believe if we can make it work on field scale, then you completely eliminate chemicals that would be required to control wheat aphid.

Lord Lewis of Newnham: Pheromones are very powerful.

Professor Moloney: Absolutely.

Q116 Lord Giddens: We have to get down our agenda, so maybe I will ask you to talk to these issues fairly shortly. You talk about a shortfall in research capacity and the ageing of the scientific cohort. Could you elaborate on how that situation has come about, how our situation compares with other European countries, whether research capacity is leaving this country and being drained abroad elsewhere outside Europe?

Professor Moloney: There are a number of issues. First, as a nation of 61 million people, we punch way above our weight in a lot of science. That's the context. Having said that, we did get into a situation which began in the early 90s where agriculture was not valued as highly as it needed to be. Agriculture and environment got a little bit mixed up in the minds of policy makers. As a result, we saw the closure of as many as 11 institutes that were involved in various types of agricultural research. What that has done is not so much cut our basic discovery research to the ground—because I think we are still very powerful with the John Innes Centre and Rothamsted Research; we still have a powerhouse of discovery going on there—but we did lose an awful lot of translational work that was possible, and that translational work is part of the knowledge supply chain. If there is a break in that supply chain we don't see the innovation moving into practice. There's a bit of a worry there. I don't believe we've lost the basic discovery, but we might have gaps in the knowledge supply chain.

What really happened was exacerbated by things like the foot and mouth disease outbreak. In fact we lost more money off tourism than we lost from agricultural production during that period and the false conclusion that was drawn was therefore that agriculture was not that important. That is rather like me saying, after some disease of grass or grasslands comes out, that we lose more money from the Premiership because games won't be played because all

the fields are destroyed, than we do from agriculture, from beef cattle. The reality is that you can live without football; you can't live without agriculture. That's a fundamental for us.

Lord Giddens: It's not what Bill Shankly said.

Professor Moloney: You may want to minute that. I should declare a conflict of interest, I'm a Spurs fan.

Q117 Lord Giddens: What about the younger generation?

Professor Moloney: That's also very interesting and a bit of a puzzle to me. In my institute we have a bit of a gap. We have some very productive senior people who are about to retire, and then there is a demographic gap that brings us down to early 40-year-olds. How did that happen? I think it is a reflection of reduction in investment in agricultural research, but it also reflects the diaspora of agricultural researchers who went across the Atlantic. I was one of them, I have to admit. I ended up working in biotech companies and agribusiness companies on the other side of the Atlantic where agriculture was still seen as a potentially profitable business and is run in that way. I think we've lost part of a generation and we have a bit of a job to do with our younger people now to ensure that we rebuild the momentum in agricultural research and get the current cohort that is moving through to be as productive as some of these senior people that started work in the sixties and seventies and became eminent international scientists. In addition to the institutes, we have reduced the number of faculties or schools of agriculture in universities. That is a bit of a danger, but why did it happen? It was probably because a lot of the industries moved offshore, which relates to another topic which is to do with the regulatory environment in which we live. But we have lost a lot of potential jobs for people trained in agriculture which we would have had if things had gone a bit differently on the regulatory front.

Q118 Lord Lewis of Newnham: How far is this related to the absence of GM research in this country compared with the States? I got from your earlier remark that one of the things you were doing in the States was GM.

Professor Moloney: Interestingly enough, I didn't go to the States because of GM—because it hadn't been invented. I was one of the first people to do it. I went over there and there were ambitions to do this kind of stuff and the reason I did it was to reduce chemical usage in agriculture. That's how I got into it. I am of the generation of Neil Young and *After the Gold Rush*, and that was when I began to realise we had to do things for environmental benefit. I helped to develop GM technology specifically to reduce chemical inputs. We were successful, because the insecticide use in North America has dropped by 40 million pounds a year as a result of the introduction of Bt technology into corn and cotton and some other crops. It is an important part of what has happened in agriculture and it is hard to look across the Atlantic and see that most of the biotech companies were full of Brits during that period. During the eighties and early nineties you couldn't walk down the corridor of an agricultural biotech company or big companies like Monsanto or Dupont without tripping over ex-pats. That definitely happened. There was a diaspora and many of them turned out to be leaders of the industry in many respects.

The Chairman: We might have to leave that there and go to Baroness Sharp.

Q119 Baroness Sharp of Guildford: It does follow on. You talked earlier about regulation and you point up in your paper the disjuncture between the restrictive regulation in the EU and the lack of resources for agricultural research in innovation—the biggest threat, as you put it, to long-term viability and competitiveness of EU agriculture. Can I ask

Professor Moloney: First of all, the regulatory framework has made it very difficult for agricultural scientists with a lot of very bright ideas to get funding in areas that will eventually matter. There has been a period when it has been very difficult under EU framework approaches to propose anything that ultimately involved a GM-like product. The fact of the matter is, most of the hypothesis testing that we do in all our institutes involves a transgenic plant. If you have a gene and you don't know if this gene is capable of giving you a higher productivity or more seeds, you have to put the gene in and cause it to be expressed. So, effectively, we test all our ideas using GM technology. It's impossible to test some of these hypotheses without doing that. But it's been very difficult to do under the EU framework—to get funding if there was something like that in there. The argument would be “we'll never be able to commercialise this”. The reality is that it takes 10 years or more to commercialise a variety, even with conventional plant breeding. We have to have a much more forward-looking approach. As to whether that will change with the EU, we do hear signals but it's been very heavily dominated at the Commission level, I believe, by forces that are very suspicious about technology when applied to agriculture and food. We somehow need to reduce the level of suspicion and apprehension about these things, because there is nothing sinister going on. To come to the BBSRC question, I was very pleased to see how influential it and the research councils were in the recent Comprehensive Spending Review. Clearly, we have a Government that does understand the idea that science is an investment in our future and not simply an expense. In this country, even with the difficult financial times that we have, I am very confident that science is properly appreciated as a long-term investment. Whether the BBSRC can have that kind of influence at EU level is very difficult to say. We have very good relationships with, for example, our counterparts at INRA in France. We have good relationships with organisations like the Fraunhofer in Germany, and we regularly exchange ideas, best practices and strategies that could potentially bring us all together for more ambitious global projects. Whether the BBSRC can have a direct influence on EU policy is a difficult one. I'm not sure. That is going to have to come from the member country at a very high level.

Q120 The Earl of Caithness: Would you agree with the evidence that we got last week that the EU is not a level playing field for agriculture when you look under the umbrella of EU research—excluding GM—because of the structure of agriculture, which is basically comprised of small farms and one or two industries, rather than, for instance, the health sector where there is a mass and that therefore the EU has intentionally or unintentionally discriminated against agriculture when it comes to research?

Professor Moloney: I think they have, and it is an unintended consequence of the policy, but that is what has happened. The Common Agricultural Policy, which is not intended to deal with the issue of research that much—it's intended to deal with the issue of production and environment—became so complex. We are beginning to deconstruct it and turn it into something more logical, but it became so complex in the 1980s and 90s that there were a

variety of unintended consequences, one of which was not to worry about productivity because there are subsidies everywhere and we can clearly produce more than we will ever need anyway. That was a false conclusion, because agriculture can be subject to fluctuation. One price fluctuation in oil, phosphates, or nitrate availability and everything can go crazy—as we saw in 2008. The Common Agricultural Policy has caused more confusion on what the objectives of farming really are. Of course, it has not even been a level playing-field between different countries either, because it was very much structured around French and German accords, even before the UK joined the EU, so it has taken a lot of time to deconstruct the CAP into something that will be a force for good; sustaining the farming enterprise, ensuring that despite the price of land and cost of living in Western Europe we can still conclude that farming is something that is worthwhile doing. We have to take care of all that, but at the same time we have to recognise that it is a real business, and businesses thrive on innovation. That's how businesses get better; we need to figure out a way of ensuring that we can promote that.

Q121 Baroness Parminter: You have said today that we need to rebuild momentum in the younger cohort. In your submission you were very clear that at degree level, at college level, and even as far back as A-level, we're just not attracting young people, and it sounds as though you think that is because they are not seeing that there are the jobs available in the industry in this country. Using your experience in America and what you know is happening in Europe, could you give the Committee some practical steps as to how we might reverse this trend and get younger people into the industry?

Professor Moloney: It is one of these things where it is hard to know which was the cause and which was the effect. My general belief is that if there are enough jobs out there for people studying agriculture. It is worth remembering that you can study agriculture and end up in many more professions apart from actually being a grower or a farmer. There are many other things you can do; agricultural research, development of biofuels, policy initiatives and even legal frameworks around agriculture. To have a knowledge of agriculture is a fundamental step in us continuing to be good at all those professions. We have lost a lot of industry for a variety of different reasons, and I hope that we will be able to rebuild some of those industries. Then, if you look at the other things that have gone on, there are certain aspects of science that I mentioned earlier on, which are much more in vogue than others. One of the areas that I have been involved in is molecular biology. These days, it is not hard to get a graduate from any of our major universities in biology who knows lots and lots about molecular biology, as they should, but if you ask them some serious questions about agriculture, they've never really had any course work that exposes them to that. That is a surprise, because agriculture is so fundamental to our way of life. It may be that the jobs aren't there or that there are other influences, but at some point you should not be able to get a degree in biology in the UK without having some understanding of how agriculture works—whether it's animal agriculture or plant agriculture.

The Chairman: Lord Lewis, are you going to go on as well to your knowledge transfer question?

Q122 Lord Lewis of Newnham: Well, I'm with you all the way there, but I find it a rather interesting, if not unique, approach. Very rarely is the same emphasised in the university system. One of the things I find interesting is that, when I visit places such as Rothamsted and John Innes, the people to whom I talk are from the physical sciences of the university; people who have done botany, zoology, biology, chemistry, physics or something like that. Very few of them have ever done agriculture as a subject. There seems to be a

difference between these two groups of people. The old agricultural colleges were not interested in designing people to go on to do research in agriculture; they were interested in turning people out who did agriculture and went out into the fields and became farmers. As you rightly said, a large number of those institutions have disappeared. Are there any prospects of them reappearing and, if so, would there be a need for them?

Professor Moloney: Actually, I think there are a number of reasons why they could reappear. This is a personal observation. Since I have been at Rothamsted, I have worked with an organisation called LEAF—Linking Environment and Farming—and that is because one of our board members is the managing director of LEAF. It is an organisation that is very realistic about farming as a business, but works with farmers to develop farming as a sustainable business. I talk to quite a few farmers about these things. In Britain, we have an echelon of very educated farmers who are doing experimental work on their farms to see if new practices can work for them. That is a glimpse of what the future might be in agriculture—people who are trained in agriculture and who have got a little bit more of an experimental approach to life and will try to incorporate innovations into their farming practices. If that is really going on in British farming, and it is not just the sub-group that I am meeting, there is a great future for our agricultural colleges because we will be teaching people not only how to grow food but how to build a business that learns how to incorporate innovation, test it out and make it robust for their own purposes. That may be one of the drivers—the fact that people are much more innovative at farm level.

Q123 Lord Lewis of Newnham: Can we go on to knowledge transfer, which we have been touching on all the time? It is one of the most important factors between the two extremes in this business. You note in your document—and I congratulate you on an extremely useful document—that the peer group knowledge transfer can be very effective. I think you talk about “over the garden fence” as an analogy and about how some of the Defra efforts can be critical, although you imply that they are somewhat limited. In terms of the role of researchers, can you suggest how specialist training could enhance the knowledge, because it seems to me that the transfer is very important? There used to be methods that were used by Defra in the past, which seem now to have disappeared. What is your view on that aspect? How are we going to get this transfer through? At the end of the day, if the most esoteric research in your establishment does not end up in the fields, in many ways it may as well never have been done.

Professor Moloney: Exactly. That is really important. If you look at the history of Defra, they have been a force for good in translating a lot of the science that is done at a place like Rothamsted into useful systems and useful policy. The Department is going to be in some difficulty right now, because I know it has taken a significant cut, but it has nevertheless contributed very significantly to that translational aspect, which is really important. I hope we will be able to get more of that done eventually. On the other side of it, looking at knowledge transfer as a supply chain, just as we were talking about the food supply chain, the key thing is to ensure that there are no gaps in the supply chain, because whenever there is a gap that is when things fall off the edge and never end up being used. We have thought long and hard about ways in which we can enhance that. I was on the equivalent of the BBSRC council in Canada for many years—the Natural Sciences and Engineering Research Council. We developed a number of post-doctoral fellowships where the post-doc spent a significant amount of time in industry. The theory behind that was that although they worked in a university or an institute, they had spent quite a lot of time in the industry because a lot of technology transfer takes place through people. If you embed the right people in the right places, you can get a lot of technology transfer. One of the things we

could look at, at the BBSRC level, is something in which we really promote that kind of interaction. It could certainly help with the larger agribusiness companies to move out pretty solid technologies that ought to be applied. It may also help with SMEs where you could really give energy and drive to fledgling companies in areas of agricultural technologies to thrive and build a business—based on the fact that these people are embedded and are taking technology that has been developed in our universities and institutes. We have to look at mechanisms by which we can enhance that, but I am a strong believer in doing an analysis, like a food supply chain, and making sure that we do not leave any big gaps there, because if we do, great technology can languish.

Q124 Baroness Sharp of Guildford: There are already case studentships and knowledge transfer networks, which have been developed by the research councils as a mechanism of technology transfer by taking young postgraduates and post-docs and putting them within a company framework and so forth. Has Rothamsted been involved in any of these?

Professor Moloney: Yes. Every year we have probably about 11 or 12 case studentships. I am very supportive of those and I think they are a very good thing to do, but if we could enhance it with a post-doctoral programme, where people have taken their science a lot further, we might be able to get more knowledge transfer taking place.

Q125 Baroness Sharp of Guildford: And then there are the knowledge transfer networks, which I think have gone out of the Technology Strategy Board. Are you involved with any of those?

Professor Moloney: Yes, in a couple of ways. One is that we try to feed our ideas to TSB, because they have special calls for areas of interest. So we do try and feed ideas in there, where we believe there is a strategic interest. When the calls are out there, if the call is at all within our remit we have benefited from that over the years. Yes.

Q126 Baroness Sharp of Guildford: Do you see an expansion of these sorts of mechanisms?

Professor Moloney: The TSB and what used to be the LINK programme are a critical part of that knowledge transfer. If we did not have those we would be in a lot of difficulty.

Q127 The Earl of Arran: You have touched on this the whole time; the really worrying and bold statement is about the fact that methods in farming have not moved on much since the 20th century. Can you identify the sectors where this has been particularly relevant? Can you compare the resulting loss in our productivity to that of our competitors across the world and how do you see this improving? Is it in your opinion possible to galvanise EU agribusiness into improving its profitability? Do you work with farmers who are less risk-averse than others and therefore more likely to go for the new innovation methods?

Professor Moloney: On the first point and the evidence, if you look at our major crops, wheat—extremely important—our major oil seed, oilseed rape, and major carbohydrate crop, sugar beet; over the last 15 to 20 years, instead of getting steady increases in output we have plateaued out on all three of those crops, not just in this country, but in Europe. That is quite scary, because if you go across the Atlantic and look at soybeans, corn or cotton and if you look at the amount of innovation that has been applied to those crops, the yields have just gone up and up.

Q128 The Earl of Arran: Is that to do with the soil elsewhere?

Professor Moloney: I don't think it's to do with the soil. I think it is to do with the fact that once you really recognise that you're working with a business, you have an incentive to introduce whatever technologies are needed to increase output for profitability.

Q129 Lord Lewis of Newnham: How far is that GM product?

Professor Moloney: GM has made a significant contribution. For example, in corn everybody thought that it would plateau out around about 140 bushels an acre, even with the best hybrids, and then Bt was introduced and it is now up above 200 bushels per acre. It has continued because there has been focused input of any available technology, but it isn't only GM, it's a combination of factors. Our wheat crop has the potential to yield a lot more than it does, but we haven't yet put anything like the level of innovation and technology into the wheat crop that we ought to. It is partly because there are no hybrids, and that means that companies have less of a repeat business, whereas the corn crop is virtually all hybrid these days. Having said that, wheat is such an important crop that we can't let it languish or plateau when there is still a lot of yield potential available.

Q130 The Earl of Arran: And how to galvanise UK agribusiness into trying to improve its profitability?

Professor Moloney: This is a very complex equation. First, the changes to the Common Agricultural Policy will eventually emphasise the fact that farming is a business, and the people who run their businesses well will be more profitable. That will be one aspect of it. We need to figure out ways at the regulatory level to make it easier for innovation to be used in Europe. New technologies that end up in agriculture in North America are not just rubber-stamped; there are very rigorous regulatory systems that protect and safeguard the general public from using a technology that might turn out to be hazardous. But we have such a level of complexity for any of the agribusiness companies to register a new product, whether that is a new agricultural chemical or a new genetic material, that it holds us back substantially. I don't think that is really the attitude of the UK. I talk to a lot of farmers in the UK and all the ones I talk to say that if there was a GM oilseed rape available right now they would be using it. They just see how clean the fields are in Canada and they say that's how we want to be able to do it. In Europe in general, it is still going to be difficult to move these things forward, but we are going to be left in a situation where the rest of the world is doing this. We will be importing products which are GM, because now you can't even source soybeans—or any substantial amount of them—that aren't. We will be eating them and using them, but we won't be growing them. That means that we don't benefit from the technologies. Many of those technologies were developed in Europe. The ability to put a new gene into a plant was developed in the University of Ghent and the University of Leiden. The target for the herbicide resistance called Liberty resistance was isolated in Rothamsted. We have a long history of innovation, but other people then had the opportunity to capitalise on that. Maybe in Europe we could even jump one step forward by changing regulations in such a way that facilitated things that even in the US they couldn't do. I will give you two examples. One is you simply say we don't now regulate GM by so-called events, but just by the gene. Whatever the gene is, that's how you regulate it. There would be no hazard to the general public to do that, but we would actually be one step ahead of North America. We'd be making it easier for people to move these things through trials and test them out. It wouldn't cost us anything to do that, but it would take a certain amount of persuasion and leadership at the level of politics.

Q131 The Earl of Arran: This is totally out of order with the question. With the increasing food scarcity and increasing populations, do you ever foresee the use of a pill possessing all the right nutrients to satisfy human hunger?

Professor Moloney: No. It is a very interesting question. I have been in quite a few debates with folks about food security and how we could feed the world and so on, and one of the standard debating issues is: there is enough food around the world but we all have to be vegetarians. And I can't argue with that. If we increased our agricultural productivity by about 20% and everybody agreed to be a vegetarian, we could probably do it. But we all know that is not going to happen. It is not going to happen for a variety of reasons, including cultural reasons. So, once one takes into account all the different cultures of the world, we are going to have to be pragmatic and deal with that. As for the pill idea, I know we have vitamin pills, but there is the issue of calorific value and the amount of amino acids that we need, essential amino acids from various proteins and so on. We are still going to be developing culinary delights through our food production.

Q132 The Chairman: You have touched on the question of EU regulatory obstacles. In your submission you clearly see a big threat from these to long-term yields. How do you think this is going to work out? How do you think regulation, particularly in the UK, I suspect, given the devolution of this, is going to be applied? What could be done to make it more proactive?

Professor Moloney: The devolution idea is a very good first step. It will be interesting to see which countries take the initiative now to begin trials. As you know, you can actually do trials in the UK. They are very rigorous, but we can do them. We fully intend, in Rothamsted, to field-trial some of our material. I am used to going through all the regulatory hurdles necessary to move something out into the field. That in itself is not a problem. But we need to consider a law and order issue. Traditionally in Britain, when there have been field trials of transgenic crops, those crops have been destroyed by activists. Given that it was a legal activity that was permitted by the Government, we need to protect against them. It costs about 10 times more to run a field trial in Europe than it does in North America right now. Nobody would think of going into a field and trashing it these days in North America. It is just not that big an issue. We need to figure out a way of reducing the cost. The John Innes Centre just did a trial of Jonathan Jones' potatoes against late blight—in which I have a vested interest, being Irish originally, since that was the cause of the potato famine. But 90% of the cost was security, and that's a situation where we ought not to have to worry about these things.

Lord Lewis of Newnham: And it takes 10 years of time.

Professor Moloney: That's right.

Q133 Baroness Parminter: An alternative way of looking at that is that those activists, as you've said, are trying to get the consumers engaged in a debate over which they feel they have no control. It's at a late stage. At what point would you say it is possible and it is right for the consumers to be engaged in the key question of who shapes the debate around innovation? If you leave it until the last stage, of course it is going to be about violence, because people don't feel that there is any other way that they can get their voice in. How would you, as a leading practitioner, welcome the engagement of consumers in shaping your debate?

Professor Moloney: It has been a very difficult one, because scientists, by their nature, have to tell the truth. We don't have the luxury of putting a lot of spin on things. So if somebody asks me, "Is there any risk associated with GM?", I can't say no. I can say that there is no incremental risk, but there is risk, obviously. If I was approaching this from an ideological point of view, I would have the liberty to put all kinds of spin on the problem. Those are the scare tactics that have been developed. So what we have ended up with is a very asymmetric debate where the scientist, like a member of the priesthood, has had to tell it precisely the way it is. There is this unfettered exaggeration and spin on the other side of the debate. The only way you can deal with that is through national leadership, when the national leaders come out and say they are not interested in hyperbole or spin; they are interested in building our practices, our industries and our approaches to food production based on good science. If that message got through time and again, not just from scientists—it sounds self-serving when scientists say it—but from the political milieu, if that message were propagated, I think the consumer would feel a lot more comfortable. The debate would then be tuned down simply to the level of discussing the things that we know, not the things that we think might happen. We have had all these predictions about what is going to happen with transgenic plants for the last 15 or 20 years. None of those predictions have even been close to being realised. Nothing bad has happened at all. 300 billion meals have now been served which contained a GM product and nobody has complained of even a sneeze, as far as I know. It is time to begin to get the discussion to the level of rationality, as opposed to hyperbole. That is the important thing. I gave a talk at a church in St Albans last week on biotechnology in food production. 300 people turned up. It was Guy Fawkes night and I was prepared to be thrown on the bonfire at the end of the talk. They were very receptive, and I received about 20 e-mails afterwards saying that this was the first time they had actually understood anything about biotechnology and GM and that it was nothing like as scary as they had been led to believe. People can be persuaded that there is nothing particularly strange about this and it is just another form of agricultural improvement.

Q134 The Chairman: On this point, do you want to say a couple of words about the pesticides directive and the alternative to the use of pesticides? The question is, if that comes in, will it drive innovation; and are there solutions out there that can fill the gap?

Professor Moloney: What we worry about—this is not a particularly pro-industry stance—is that many of the agricultural chemicals, which we would eventually like to supplant with other methods, are regarded by the producers right now as being essential to their viability. Some of the EU regulations on curtailing the use of some of these chemicals have not been based on any new toxicology studies that have told us that there is some danger that we did not know about. In fact these things have all been tested for quite a long time. It is more of a precautionary principle response. The precautionary principle is very dangerous when it is used capriciously or just in selective cases. Both the farming community and, legitimately, the agricultural chemical industry have said that these chemicals may be curtailed from use for reasons which are not because of any rigorous new science. At the same time, we have not had the opportunity to do the necessary research either to find new targets and better chemistries or alternative approaches such as natural pest resistance. We have not had the time to deal with that. You have to look at the risk/benefit relationship. If, precipitately, some of these fungicides were removed, we can guarantee that the remaining fungicides will be used more heavily, temporarily. That will cause selection within the pathogens, so the pathogens will become more resistant to this remaining group faster. All the fungal ecologists will tell you that is guaranteed to happen, so we need to look very carefully from an ecological point of view. Ecology works both ways: protecting the environment and knowing how evolution works. The higher the selection pressure, the more likely you will

have a mutant that gets around that pressure. Eventually you could run out of solutions to controlling pests. That is the biggest worry. It is not just the industry. If you talk to a lot of the educated farmers that I have been talking to, they will tell you the same story: they are really worried.

Q135 Lord Lewis of Newnham: Your real argument is the precautionary principle and the application of it. It is not a unique experience. This applies in many other areas. Very often it is based upon surmise rather than upon fact.

Professor Moloney: It is. In a philosophical sense, it is almost self-contradictory as a principle, because it doesn't take into account the fact that you will have unintended consequences by applying the precautionary principle; and some of those unintended consequences could be worse than the thing that you are trying to protect against. It is a bit circular. I am sure that schools of philosophy around the world have been generating PhDs on that subject alone.

The Chairman: Perhaps we can get more down to earth and move to the Common Agricultural Policy.

Q136 The Earl of Caithness: My first question is that, given that there is going to be a review of the CAP in 2013, have the EU consulted Rothamsted?

Professor Moloney: We haven't had any formal requests at this time. We would certainly be open to providing some suggestions, but we haven't had a formal request at this time.

Q137 The Earl of Caithness: I am saddened to hear that, but I am delighted to hear that you've got lots of ideas. Can you tell us some of these? You state in your paper, and you have said, that the EU is a hindrance. We have talked about GM and the use of chemicals. Can you give us some other examples? Do you see the EU forever being a hindrance rather than a help? Farming invented itself in all sorts of ways in the last century. It fed 4 billion more people without any help from Governments to begin with. Shouldn't farming be allowed just to get on with it while you do the innovation, and the farmers will get on with it, too?

Professor Moloney: I am certainly a believer that the market can cover a lot of aspects. However, if you think about how the Common Agricultural Policy evolved, it was because we were relatively rich nations that needed to grow food and give incentives for growing food. Yet, with the cost of land and the standard of living that we have in Western Europe, sometimes you may have to put some money into that in order to ensure that everybody continues to farm. That is the history. The problem is that if the process of providing subsidies is all that happens, eventually those subsidies take the place of the incentive to go after innovation, because profitability is now based entirely on playing the subsidies rather than saying, "I want to have more productivity or higher quality of my product, and get value from it". Having said all that, I think a very important opportunity has emerged because of the confluence of our understanding of world food security. There are very legitimate concerns about the environment in a general sense, particularly the countryside environment, the farming environment that we shape, and our commitments with respect to climate change. All those things have come together in less than the last 10 years. They give us a framework to look at the CAP and say, "Are there things that we can do which are to the benefit of all those aspects?" One of the things that we could do is to reshape aspects of the Common Agricultural Policy so that the paybacks that go to farmers are based upon the introduction of innovative approaches that reduce our carbon footprint or benefit

biodiversity at the same time. As you know round the table, probably 16-17% of the world's greenhouse gases are the result of agricultural practice. It is hard to believe—we ought to be saints—because in most of what we do we absorb CO₂ from the atmosphere as we grow food. But it is all those other things—methane from livestock and nitrous oxide, which we generate when we apply fertilisers—that give us a significant carbon footprint. At the same time, agriculture has the opportunity to do the other thing that you were talking about, which is sequestration, or using waste products in ways that can also mitigate our carbon footprint. My view is that we all understand that in the EU. This is not just a crystallisation of ideas in the UK. The French understand this, the Germans understand this, as do the Belgians. Everybody understands these issues and we have all come to grips with them. Maybe there is an aspect of reshaping the CAP to look at the green economy, which is where we have to be heading. In the same sense, if I were in industry and I purposely took steps through investment to reduce my carbon footprint by 10%, I would be eligible for carbon credits. Right now, that is not true of a farmer. Whether you are a farmer or in a collective group of farmers, if there were changes in agricultural practice that could be proven by rigorous bodies like Rothamsted or by Defra funding research in this area, so that you could prove that you were reducing your carbon footprint, then you ought to be eligible for credits. To me, that would be a good use of CAP money, because we would be promoting good practice and sustainability. All this is due to the incorporation of innovation. That is one of the ideas in the reshaping of the CAP—that farmers get paid for doing the right thing and for incorporating innovative ideas.

Q138 The Earl of Caithness: Can I ask you to follow that up with regard to Pillar 2 and the environment? At home in Scotland there has been a huge change on the hill. A lot of people are now living off the subsidy and doing little or nothing. The farmers were consistently improving their stock, improving the hill and getting better quality lambs and beasts down to the market. A lot of that has changed. Now they can sit back and take the subsidy because the stocking rate has dropped hugely, the hill has changed and the farming practice has changed. Can you talk a bit more about that environment, particularly with regard to the cropping, which is your speciality, rather than the beasts?

Professor Moloney: If you get to the point where, for example, you have fewer livestock and you live off the subsidy, you have to push it to the next question. Is there something else we can do with that land that would be environmentally beneficial and possibly profitable? There is a point where you might look at bioenergy strategies; or you might look at something as simple as some of the supergrasses on these hillsides where you sequester enormous amounts of carbon in the root systems. Just by doing that, if you then did a calculation nationwide of how much carbon we sequester by purposely growing grasslands root systems that are much denser than are typical, we could argue that we are fulfilling a substantial percentage of our requirements under Kyoto and Copenhagen. So there are still things that we can do there. That is very different from simply living off subsidies. We can go to the next hurdle and contribute to solving the problem, which is a national commitment right now. Whatever incentives we provide ought to include activities like that.

Q139 Lord Lewis of Newnham: You mentioned carbon credits for agricultural purposes. One area that appeals to me is forestation, where this is a primary issue. The subsidies in that area are relatively low, and this would be an opportunity to accomplish this. Can I turn back to a point that you made at the beginning and ask what the EU is doing about it? You emphasised that there was a problem over soil, water and phosphate. The phosphate situation is going to become critical, because we are mining the bulk of it in North Africa. Unless some other sources of it are found, we are going to be in a critical

situation over phosphates in a relatively short period of time—30 or 40 years is my impression. What work is being done in the EU on addressing alternative sources of phosphorus? As you rightly say, we are made up, to a large percentage, of phosphorus, and we are letting that go away. Also, what is the position over soil?

Professor Moloney: I would say that the one prominent organisation in the EU that is taking these things seriously is INRA in France. There is a substantial investment in INRA. They have far more institutes than we now have in the UK. They focus on things like soil science and on nutrient assimilation in the soil. Right now, the best approach that we can offer—we will happily collaborate with some of the institutes in France on these bigger matters—is to figure out ways in which the phosphorus that is being cycled in agriculture is used maximally.

One example—which you will probably know, but not necessarily everybody in the room will know—is that a lot of phosphorus is tied up in seed material in the form of what we call phytic acid. It has six phosphoruses for every sugar molecule. So it is a sequestered form of phosphorus. It is in all the grains that we feed our animals, but monogastric animals cannot break it down. As a result, the phosphate goes in, it is eventually excreted, it ends up in the soil, and it is only later that soil micro-organisms break down that phosphate. Unfortunately, most of it then ends up in ground water. Quite apart from losing the phosphate, it can also cause eutrophy in the water, so you get microorganisms growing in it and it becomes necessary to clean it up further. So there is a cycle where we could intervene. In fact, in monogastric animals, pigs and chickens, we add phosphate to their rations to complete it, even though there is a lot of phosphorus in there. Innovation that spares the use of phosphate in that way has been developed. Syngenta has developed an enzyme called phytase, which can be added to these rations. It releases the phosphate that is already in there that would normally end up being excreted. So at least you've got some better utilisation of phosphorus. But it is a finite resource, and eventually we are going to have serious problems unless we figure out ways in which we can initially use the phosphate effectively and ultimately figure out ways of recouping some of it from soil.

Lord Giddens: Some of the biggest health problems worldwide are caused by changes in diet and lifestyle. Can you touch on those? The WHO says that a billion people across the world are obese. You seem to indicate that agriculture could make some contribution. I wonder how that can be, given that these things are largely driven by lifestyle choices, which operate away from the actual producer.

Professor Moloney: I have always looked upon food production—I have argued this with my medical colleagues—as a form of preventive medicine. In the sense that we are what we eat, lifestyle determines a significant component of that. What we have in our raw materials that go into food can have an enormous impact on our health and wellbeing. One example is quite relevant to the work that we do in Rothamsted. I am pointing it out not to be self-serving; it is just a very good example. Our brains require a lipid called docosahexaenoic acid. It is one of the major lipids that are found in brain tissue. It is an essential fatty acid in our diet. It is interesting that humans absolutely require the incorporation of this omega 3 fatty acid. We need it in one form or another in our diet. That is probably because we evolved as a civilisation closer to water and to the sea, and everybody in the early days of human civilisation had access to fish. It is very interesting that now, even in developed countries with very good nutrition, even in the UK, one of the things that we are still deficient in—not everybody in the room, but on average—is the intake of some of these omega 3 fatty acids. The only way you could remedy it would be either to eat oily fish twice a week or to take some kind of supplement. Some people take supplements, some people eat fish, but there is a significant proportion of the population, even of the UK, that are short

on that. If you can't get people to eat enough fish, or if it is more complicated now because farmed fish doesn't have enough of it—farmed fish don't have access to the algae that make the docosahexaenoic acid in the first place, so there is a break in the food chain there—we need to figure out a way of supplementing that. A researcher in Rothamsted, Jonathan Napier, has developed terrestrial oil seeds that make these oils. We can get that back into the food chain in the UK. We can't do it right now, but we will eventually be able to do that. You can go up to Scotland, where there is a big aquaculture business, you can introduce into the feed meal the necessary oils that the fish would normally have got from eating krill and algae, and they will act like oily fish again. So, even if you bought fish in a fish-and-chip shop, you would have a significant amount of DHA, this omega 3 fatty acid. How important is it? It is essential for visual acuity and brain development in infants. If you look on any baby formula tin now, it is added to baby formula. A company called Martek in the US produce it by growing algae in large fermenters. It is already a very critical element in the food chain. Clinical trials have demonstrated that it improves memory in older people. While it would not be a cure for Alzheimer's or anything like that, it could well be a factor in reducing brain impairment over time. It has also been demonstrated in clinical work to be beneficial for cardiovascular health—in the reduction of circulating bad cholesterol, LDL, and in the induction of circulating good cholesterol, HDL. That is one example where we can make a difference in preventive medicine through an agricultural product, which could end up in anything from baby food, yoghurt, right through to the fish that we farm.

Lord Giddens: Thank you. That was a very interesting note to finish on.

The Chairman: Professor Moloney, thank you very much.

Q140 The Earl of Arran: Could I ask a very quick question? I found it very worrying when you said that as yet you have had no request from the EU as regards the forthcoming CAP talks and your requirement for advice and information on this. Even if you don't get a request from them, will you still be giving them a paper?

Professor Moloney: I would be very happy to. We believe we ought to be able to provide some good and creative ideas that ought to be considered.

Q141 The Earl of Arran: Were you asked in the last round of CAP talks to give information?

Professor Moloney: I don't know because I wasn't the director at the time. I have arrived relatively recently. I took up this position on 15 April.

Q142 Lord Lewis of Newnham: Shouldn't this be done through Defra?

Professor Moloney: I'm sure Defra would be a part of it, but occasionally we are approached directly by the Commission. I will find out from our colleagues in Defra if there is a process already in play. Normally, they communicate with us and ask us for information. I will follow up on this.

Q143 Baroness Sharp of Guildford: In the Framework Programmes, institutes like yours frequently play a substantial part in helping to frame the questions that are then developed within the Framework Programme. Indeed, it is not a bad thing to do, because the comitology of the EU is such that, if you are there helping to frame the programme, you get prior knowledge of what is going in there and you are seen as being a good player, if you like. So it plays two ways.

Professor Moloney: I think we have two vehicles for doing it. One is called EPSO, the European Plant Science Organisation. That is entirely across Europe. Universities and institutes are members, and it acts both as an academic society and a lobby group. The other area is that we have very good liaison with the agribusiness companies and we talk particularly with their communication people.

The Chairman: Thank you very much, on behalf of the whole Committee, for the very high quality of the written and oral evidence. It was tremendous.

Professor Moloney: Thank you very much for the invitation. I really appreciate it. It was very good to meet you all.

Country Land and Business Association (CLA) and the National Farmers Union (NFU)

Written evidence from the Country Land and Business Association (CLA) (IEUA 6)

1. The CLA represents 36,000 land-based rural businesses in England and Wales which together, we estimate, manage about half the rural area of those countries. Most of our members are directly or indirectly engaged in agriculture and have a strong interest in the subject of this inquiry.
2. **Definition of innovation.** The list of aspects covered in your definition seems a bit restricted. Innovation should surely include all aspects of development in farming businesses: the products and services they supply; the business forms they use to acquire their inputs and market their produce; changes in input combinations; and the technology of transformation of inputs into outputs.
3. A lot of the innovation in farming originates in the supply industries which provide farming inputs: genetics of crops and animals, plant protection and animal health products and treatments, the plant and machinery and their control on the farm, and the range of expert services available to farmers for financial, technical, environmental and marketing purposes. One of the most important areas of innovation on farms themselves is in their business organisation and especially the development of numerous forms of joint ventures: contract farming, share farming, cropping and animal licences, and the changing structure of farm tenure arrangements with the advent of the Farm Business Tenancy. These can be seen as Farming's version of what in other economic areas is called outsourcing. There have also been (and need to be further) innovation in marketing – not least in creating horizontal and vertical structures which are innovative and assist the creation of viable businesses.
4. **Innovation as a strategic objective;** certainly it should be. It is essential that agriculture is constantly innovating. If it does not, and if therefore the productivity of those engaged in agriculture is not increased with other sectors in the economy, relative earnings levels will sag. Besides this economic truth, innovation in agriculture is essential to help it rise to the new challenges which the land based sector confronts this century. We have described this as the twin challenges of achieving Food and Environmental Security.
5. In the twentieth century massive innovation on and off-farm enabled the world to feed a population which trebled with enormous rise in longevity and living standards for a third of that population and with the dietary changes that accompanied that economic growth. We all now know that considerable loss of biodiversity and ecosystem services accompanied that technical achievement and that the economic development which enabled this technical progress was based on fossil fuel consumption which is changing the climate. In the coming half century, the food production required to feed the next increment in human population challenge is smaller than for the last half century. But the challenge is all the greater because it has to be achieved whilst at the same time significantly reducing the environmental impact of agriculture on biodiversity on the ecosystem services which this life on earth supports, and whilst green house gas emissions are largely eliminated.
6. Meeting this challenge will require innovation at every level: basic science, applied science and in getting this science into practice. Farmers already have to be knowledgeable about soil chemistry and physics, about plant and animal nutrition, health, welfare and reproduction, about mechanisation and health and safety, and about business

management and marketing. But now and in the future they must also know about ecosystems, water management, renewable energy and green house gases and how to integrate these into profitable businesses. Land management is thus becoming more complex with multiple goals and will increasingly be a precision, knowledge-intensive activity. So much of agriculture is spatially defined that GPS systems and modern ITC will be a key part of serious agricultural activity which will produce the bulk of our food needs. If this is not a challenge for innovation we don't know what is.

7. It is a deeply worrying that the crafters of the initial draft of the European Union's 2020 strategy for Growth and Jobs were clearly oblivious of the central importance of innovation in agriculture and the greener economy. There is a long way to go to ensure these messages are understood.
8. **Innovation today.** Nothing to add here.
9. **Obstacles to innovation.** The first obstacle is the blinkered thinking at the highest level in the EU and the Member States who still think of agriculture as a backward traditional sector nothing to do with 'high tech'. This attitude is also strongly influenced by the warm and cuddly view of small-scale, organic and local, family farming which dominates the media discussion of agriculture and is profoundly out of touch with the reality of how the overwhelming bulk of food is produced and will be produced.
10. The CLA is emphatically fully supportive of local food marketing, farmers markets, fair trade, locally distinctive food brands, and efforts to segment the food market for example by produce which follows the rules of organic and integrated farm management (e.g. LEAF). These are all highly intelligent ways of seeking to sell quality and to achieve higher margins for primary producers. Yet, in total, and despite the massive continual favourable publicity all such specialist foods receive, together they still account for less than 5% of total consumer expenditure on food and drink. Innovation is important to all sector of agriculture, but clearly it is innovation in the production and marketing of the 95% which matters most.
11. Beyond this problem of attitudes to efficient commercial food production is the tale of systematic cutbacks in public sector agricultural R&D in Britain and in much of the western world. In the UK commentators refer to the broken technology transfer chain. This has been well documented by Prof Leaver and others through the Commercial Farmers Group and the Royal Agricultural Society of England. The missing component is in the area of applied research and knowledge transfer. The publicly supported activity has been systematically cut but the private provision has not sufficiently substituted for it.
12. Negative public attitudes have grown up around what is routinely and ritually condemned as intensive or factory farming, and the term 'agri-business' is now a pejorative descriptor. These attitudes harm the private sector capacity for innovation in farming and food production. This particularly applies to the crop protection and biotechnology sectors. It is not an exaggeration to say that some groups in society see the private sector R&D of these sectors as the work of the devil. There is a strong antipathy to the application of science and technology to food production and this is sometimes bolstered by elements of anti-capitalism, anti-profit and anti trade liberalisation. This is a potent mix which has held up some aspects of innovation in EU agriculture for two decades now with few signs that things are on the change.
13. These are extremely important matters and not easily or quickly changed. Perhaps a dose of sustained food price inflation may help a more balanced stance on these matters. In particular the pressure to develop crops and animals better adapted to the more extreme and potentially warmer climate, and greater exposure to animal and plant disease, and which are better suited to drought and saline conditions will bring about a change in attitude.

14. It also cannot be denied that the Common Agricultural Policy and its slowness to reform in the 1970s and 1980s (all the significant reforms have occurred since 1992 – and these too are probably too slow) has contributed to some of the negative attitudes referred to above.
15. In the CLA we don't consider that forestry and woodland management have always been part of the rural business our members run. The main obstacle to more attention to forestry and woodland has been its profound lack of profitability. The rediscovery of biomass based fuel and the idea that in future society may be willing to arrange that land managers – including foresters – might be rewarded for the non-market ecosystem services they deliver (or could deliver) offers some hope that the future may be different than the past, and greater innovation in forestry comes about too.
16. **Demographic structure.** This is not a fundamental factor. If farming and forestry were to show greater returns as a result of the higher pressure for the whole range of food, fibre, fuel and forest product services they deliver, and *a fortiori*, if society really does find a way to reward the provision of the non-market ecosystem services that everyone talks about these days – then there will be no problem of attracting and retaining young entrepreneurial and innovative people. Farming is an intrinsically attractive career, but if it does not provide 21st Century living standards for farming families then it will not attract people. Fewer of future generations of land managers may be the children of the present generation of farmers (for demographic reasons) but that is not necessarily a problem – indeed it could provide a much-needed injection of new blood.
17. **Future challenges:** See above.
18. **Innovation systems:** It is certainly the case that innovation has come and will come from all the parties flagged in the question. We have nothing to add here.
19. **R&D:** The issues with private sector R&D are first, the regulatory regime imposed – is it reasonable or heavy handed? And second the public discourse on food and how it is produced. Government, UK and EU, could do more to help create an environment welcoming of innovation. Public R&D will be essential – particularly to deal with the market failures which we argue are pervasive, surrounding food production. If the present financial circumstances are such that we just cannot afford to do more now then so be it. But if we do not put this right as soon as economic stability is restored then the outcome will be that we continue to fail to reach the environmental goals our societies have set. This is another way of saying that we will continue with an unsustainable food system (specifically, one which consumes natural capital at a faster rate than that capital can be restored). The fact is that the private sector is not going to fund the R&D necessary to get the correct delivery of public goods. There may be ways to create the framework and mechanisms that enable business to business funding of some of these goods but our belief is that the bulk will have to be public funded or they will not be supplied.
20. **Education and skills:** we leave it to the experts in this sector to explain the challenge they see.
21. **Knowledge transfer:** this is critical, especially now as we are struggling to get over to the present generation of farmers the technical knowledge they need both to improve their food production productivity and also to take better care of natural resources and biodiversity. In present circumstances there is no prospect of any public resource in this area so the only hope is in better coordination of private sector efforts and particularly the levy boards. The setbacks to the restructuring of the AHDB is not helping this.
22. **EU Policy.** The CLA has written extensively on how it envisages the Common Agricultural Policy should adapt, and we certainly recognise that it has an important role

in helping farmers improve their productivity and competitiveness. The CAP also provides an important element of revenue stability which is increasingly important as commodity markets and natural conditions are subject to greater volatility. However the CAP *per se* has not been a significant source of funds for R&D. Neither should it in our view. Importantly, funds are available for training and skills development and for knowledge transfer. There may well be scope to do more of this.

23. EU research through the framework research programmes, is as far as we are aware well conceived and organised. Of course such research has to provide some EU value-added, by encouraging collaboration across the Member States and by ensuring that the knowledge generated is made available across the Member States. Given the long gestation period in organising projects which can achieve this it is inevitable that such research is high-level, of broad generality and not aimed to be of immediate utility. The more applied research is bound to be organised, and thus funded at Member State or lower level.

September 2010

Written evidence from the National Farmers Union (IEUA 14)

The NFU represents 55,000 farm businesses in England and Wales involving an estimated 155,000 farmers, managers and partners in the business. In addition we have 55,000 'Countryside' members with an interest in farming and rural issues.

Inquiry into Innovation in EU Agriculture

The NFU strongly believes that scientific research and development, and innovation in technologies and practices are all vital if British farmers are to produce more food and other products, and impact less on the environment.

This is a significant challenge, within the global context of population growth and climate change. The UK has a moral responsibility to optimise its agricultural productivity as part of its role in addressing global food insecurity. In terms of climate change impacts and water availability in the medium term, we are at an advantage compared to other parts of the world. This is also true of much of Northern Europe. We also have relatively efficient farming systems, infrastructure and supply chains, sophisticated farm businesses, and world-class research centres. The NFU agrees that food security is not about self-sufficiency but does not believe it is appropriate for the UK to rely on imports from other countries for those foods we can produce here.

1. Definition of “innovation” in the agricultural context

We consider innovation to refer to new and improved approaches, practices, tools, products and technologies in all sectors of agriculture and horticulture. Innovation is possible and important in all aspects of the production system. We agree that it can include specific saleable agricultural technologies, equipment and inputs; on-farm management practices and decisions; and new ways of approaching challenges and developing policy and legislation. It can also include the scientific techniques and technologies and research methods used in the various disciplines of agricultural science.

2. Innovation in EU agriculture as a strategic objective

Innovation in EU agriculture should certainly be pro-actively encouraged. Science, technology and innovation are essential to increase the efficiency and productivity of farming systems, and thereby to ensure the EU is competitive in the global market place and can fulfil its social and environmental responsibilities. This is especially true given the support European farmers receive through the CAP. It cannot be assumed that innovation will happen inevitably, due to the nature of much of the farming industry i.e. large numbers of small and micro-businesses, risk averse, often isolated, often operating at a loss with difficulties in investment, producing un-branded commodities and certainly with no in-house R&D staff. However, most farmers are instinctive experimenters and innovators, and would want to use new products and practices to be more efficient and productive.

3. Innovation today

There are many examples of innovations in agriculture and horticulture being used now. The use of precision farming such as satellite guided machinery for field operations, controlled traffic farming, yield mapping, targeted applications and conservation tillage is increasing.

Farmers are installing on-farm bioenergy equipment such as biomass boilers, combined heat and power units, anaerobic digesters etc. as well as photovoltaic cells and wind turbines on their land and buildings. New varieties of fruit and vegetable crops are being grown for specific markets, and arable crops are bred to increase yields and, in the future, for nitrogen-use efficiency, and to stand up to pests, diseases and extreme weather. Sophisticated glasshouses are used to grow high-value fresh produce extremely efficiently in controlled environments without soil and using recycled heat and power. High performing sheep are being bred that shed their own wool, removing the cost of shearing. Genetic improvement is being used to significantly increase the efficiency of pig production such as through feed conversion ratios and litter size. Quick diagnostics for diseases in both crops and animals increase effectiveness of controls, management and ultimately productivity. New crop varieties developed through genetic modification have made considerable impact globally, but unfortunately Europe is not a conducive legislative environment or market for biotechnology companies to invest in. Current research trials with GM potatoes are exciting but are a long way from commercialisation.

To be innovative, farming must be profitable and be able to invest in the future. Returns on investment in new technologies must be achieved and new management approaches must be seen to work within a commercial farming system. Farmers must be confident that they will remain in business, by being competitive and retaining their markets.

4. Obstacles to innovation

Investment in agricultural research and knowledge transfer has been falling in both public and private sectors for the past 2 to 3 decades. This has happened across the EU, and in many third countries, to a greater or lesser extent. Unfortunately, the UK is now seen as a 'trailer' rather than a 'leader' in its overall science investment (not just agricultural), with France and Germany being the European leaders (Source: Science, technology and innovation in Europe, Eurostat Statistical Books, 2008 edition). During this time, the annual European cereal yield increase has dropped from 4% in the 1980s to under 1% today. We believe that a key factor in this is the underinvestment in agricultural R&D and KT. If there are no specialist research or training centres for specific elements of farm production, it will be extremely difficult to generate innovation in these areas.

Businesses in the food industry, and the allied agricultural industries such as crop protection and seeds, are highly competitive with each other. Companies must innovate to stay ahead and therefore intellectual property is very important to them. New product development is a long and costly process with a high failure rate and companies must see a return on investment for their business, and a competitive advantage. Farmers operate in long production cycles and are necessarily risk averse when looking at innovative approaches and products. The majority of farms in the EU are micro-businesses and do not have in-house R&D capabilities such as those in the pharmaceutical, automotive or agro-chemical sectors, or the funds necessary to pay for their own research. They also produce a range of public benefits, which means that public sector investment in R&D is necessary and appropriate.

Private sector research must deliver commercial gain for the company. However, not all research needs for farming will bring sufficient commercial returns for an individual company to invest, because of the small size of the market or the lack of a saleable product such as a farm input or piece of machinery. Also, most private sector R&D for products such as seeds or agro-chemicals is done by just a few multi-national companies. While there are examples

of such companies driving innovation in areas such as biodiversity or lower carbon emissions, they need the right climate and clear signals from government. A supporting pre-commercial research base is absolutely essential for agriculture.

5. Demographic structure of the sector

The average age of UK farmers, according to Defra, is 59 years. This has remained fairly static over the last decade. However, the number of young people going to agricultural colleges is now increasing. A combination of the economic downturn and food and farming being higher on the political and societal agenda may be leading to more young people studying agriculture and wanting to return to the family farm as a career decision. The potential for new technologies and innovation in 21st century agriculture will certainly attract some into the industry, as well as the generally more positive view of British farming and its role in food security. However, this must be maintained over many years if not decades to retain the younger people, and there are still considerable barriers to new entrants into the industry.

6. Future challenges driving innovation forward

Climate change is a major challenge. It will cause shifts in the ranges of pests and diseases, as has already been seen with Bluetongue Virus in Europe. Increased frequency of extreme weather events such as drought, flooding, heat and cold can cause serious damage to crops and livestock, over which farmers have little control. However, climate change could also give northern Europe longer growing seasons and there may be crops that could be grown commercially further north. In the short to medium term, northern Europe is likely to have a comparative advantage as productivity in other parts of the world is limited by water, temperature and radiation. If equatorial regions and other areas important for biodiversity are to be protected, European agriculture must respond by rising to the challenge of sustainably intensifying and being even more productive and efficient. Innovation will have a key role to play in this process. Governments must not hinder this but must actively facilitate it, through leadership, policies and legislation, and investment in research.

Brazil has been extremely successful in its use of science and research to significantly increase its agricultural productivity in a sustainable way without destruction of rainforests and other important natural resources and ecosystems. A recent article in the Economist (Aug 26th 2010) describes how this has enabled Brazil to boost its economy and food security and become a major global exporter of agricultural commodities.

7. Knowledge and innovation systems

Identifiable centres of excellence, individuals and networks for generating innovation and exchanging knowledge would be very beneficial for EU agriculture. There are likely to be such systems already in many countries but they could be better coordinated both within and between member states. In the UK, the close links between research, advisory, government and industry communities associated with agricultural R&D, KT and innovation have been eroded over recent decades. The Agriculture and Horticulture Development Board (AHDB) and the non-statutory levy boards (British Beet Research Organisation (BBRO) and Processors and Growers Research Organisation (PGRO) must play a key role in building this up again. Collaboration between similar networks and bodies across the EU would be very valuable and this is starting to happen, for example in the cattle sector with

Country Land and Business Association (CLA) and the National Farmers Union (NFU)

support from the Bioscience Knowledge Transfer Network funded by the Technology Strategy Board.

8. Research and Development

As written in a recent series of papers for the Foresight project 'Global Food and Farming Futures' published in the Philosophical Transactions of The Royal Society *"The need for action is urgent given the time required for investment in research to deliver new technologies to those who need them, and for political and social change to take place..."*

It is important that there is an agreed coordinated government strategy on what the priorities for research for agriculture and horticulture should be, in consultation with the private sector. This must then be used to inform all research funding programmes to get maximum value from public sector investment and from collaborative research. It should also drive the systems in place for recognition and reward of scientists and academic departments. Effective knowledge exchange mechanisms must be established to ensure research is aligned to industry needs.

Given government budget cuts it is particularly important that the greatest value and impact is extracted from public sector research. The balance between basic and applied research funding must be reconsidered, with investment in applied science boosted. Translational research i.e. taking scientific discoveries and knowledge closer to the point at which they can be used by practitioners, and skills in knowledge transfer must be recognised and rewarded at universities and research institutes in the same way as basic science. Funding streams for knowledge transfer and exchange work must be accessible to all research centres, institutes and universities. For UK agriculture and horticulture, the money paid by farmers through the levy to the AHDB must be used to greatest effect, and research collaboration with the private sector must be facilitated.

9. Education and skills

The consideration of skills in all aspects of farming including science and the advisory sector is too large a topic to cover in this response. There is certainly interest within the science community in agricultural research but if the rewards, recognition and career progression are skewed towards basic and away from applied research, scientists will be discouraged from taking this path. The number of agriculture colleges and university departments is now much reduced, with some specialist subjects, such as agricultural engineering, having only one centre for research and study. It is widely recognised that many areas of applied agricultural science, such as engineering, agronomy, soil and weed science, livestock nutrition, physiology, pathology and entomology, are suffering from key people reaching retirement age and not enough scientists coming through the system to replace them with the right combination of practical and scientific skills. The new BBSRC Advanced Training Partnerships are designed to address some of these concerns.

In terms of farmer training and skills, the NFU is a founding member of the Agri-Skills Forum, an initiative to promote the recognition of skills in the agriculture sectors and encourage the take-up of training and CPD in the industry.

10. Knowledge transfer

Farmers and growers are highly diverse in terms of their needs, attitudes and capabilities in the adoption of knowledge transfer. Therefore, a variety of methods must be used to enable the results of research to be taken up and applied commercially, including one-to-one advice, producer groups, benchmarking, demonstration farms, workshops, fact sheets, trade press articles etc. As well as the levy boards, there are several farmer-led organisations and independent research centres of various scales that do near-market research and knowledge/technology transfer to farmers (e.g. East Malling Research, TAG NIAB, Stockbridge Technology Centre, Velcourt, JSR Farming Group, Kingshay).

It will be harder to transfer knowledge about farm management practices compared to products or technologies that are sold and used by farmers, such as seeds, breeds, machinery or pesticides. It is vital that practices as well as products are picked up commercially because technologies or new varieties and breeds will not improve productivity if the management of the production system is sub-optimal. Knowledge exchange is also essential, to improve KT and ensure research is informed by, and well-aligned, to industry needs.

11. EU policies

EU research policy must give a strong and sustained driver to agricultural science funding. The goal must be clear in terms of what science and innovation should achieve for the economic and environmental sustainability of EU agriculture, and their role in the competitiveness and food security of the EU as well as the EU's responsibilities globally. There are significant benefits to having EU funding in the form of the Framework Programmes and there is potential for CAP funds to be used to boost the productivity and competitiveness of the sector through R&D investment. International collaboration can be very valuable when there are common challenges and particular expertise or centres of excellence in certain countries. The sharing of data and training of scientists is also facilitated and should lead to benefits for the agriculture and horticulture industries across Europe.

A copy of the NFU's 2008 report 'Why Science Matters for Farming' has been sent to the Committee clerk. The questions in this inquiry cover a huge number of issues of relevance to the NFU's work on agricultural science policy and the comments in this response are necessarily brief. If you would like to discuss any of them further, please contact Dr Helen Ferrier, Chief Science and Regulatory Affairs Adviser.

23 September 2010

Oral evidence, 1 December 2010 (am) Q 144-178

Evidence Session No. 4.

Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
Lord Giddens
Baroness Howarth of Breckland
Baroness Sharp of Guildford

Examination of Witnesses

Witnesses: **Dr Helen Ferrier**, [Chief Science and Regulatory Affairs Adviser, NFU] **Allan Buckwell** [Director of Policy, CLA], and **William Worsley**, [President, CLA].

Q144 The Chairman: Professor Buckwell, Mr Worsley, welcome back. It is nice to see you again and thank you for coming. Dr Ferrier, thank you for attending today. I shall deal with the formalities first. You have in front of you a list of interests that have been declared by Committee Members. As you know, this is a formal evidence-taking session of the Sub-Committee and a full transcript is being taken. That will go on the public record in printed form and on the parliamentary website. We will send you a copy of the transcript and you will be able to revise it for any minor errors. The session is on the record and is being webcast live and will be subsequently accessible on the parliamentary website. For the record, could each of you please state your name and position and then we can move on?

Helen Ferrier: I am Dr Helen Ferrier and I am the Chief Adviser for Science and Regulatory Affairs at the National Farmers' Union.

William Worsley: I am William Worsley. I'm president of the CLA and I'm a farmer and forester from North Yorkshire.

Allan Buckwell: I'm Emeritus Professor Allan Buckwell. I'm the policy director of the Country Land and Business Association.

Q145 Baroness Howarth of Breckland: I assume you are happy to go straight into the questions. We were very interested that you slightly told us off that we could be looking at

broader things than the list that we gave you. We are fine about that and we'd like to hear more about it. Maybe I could ask the NFU first, in section 3 of your written evidence you offer a range of examples of innovations in agriculture. We are interested to know if there is a common thread to these. How do you conceptualise that? Can you identify the characteristics of an innovative farm or farmer? Taking a couple of arable and livestock examples, could you explain what stimulated them and how they were fed through the farm?

Helen Ferrier: The common thread is increased efficiency of production. As a high-level strategic direction for agricultural research, that has to be the goal. There are lots of things that affect the degree to which you can have an efficient system, such as pests and diseases and losses from the system. That brings you down to improving the genetics of the animal or the plant, and at the same time looking at the management of those systems, because you can't have an efficient system just based on good genetics if your management isn't there. All those examples are happening now, but that should be for the future and the overall direction of research.

What is an innovative farmer or an innovative farm? It is important for a farmer or grower to have a basic understanding of the link between the inputs—how they are managing their farm—and the outputs of production and their balance sheet. That is not necessarily there for all farmers. Not all farmers necessarily fully understand their cost of production, for example.

Then there is the constant looking for ways to improve all those things that they are putting in, testing those and having some methodology there so that you can see what result you have had from your changes in the system. Then, as with anything, there will of course be some early adopters of new technologies. Like some people always have the latest mobile phone, there are those farmers who are always keen to try out the new bit of kit or to set up a new way of doing something. They are at the forefront. What would be good, and certainly already happens, is that these act as demonstrators to their peers. Generally farmers have to be risk-averse. Because of the long cycles of production that they have to operate under, they can't really risk things failing. Some will, but innovation is inherently a bit risky, so if you can see something working commercially, because your neighbour is doing it, that would help.

Q146 Baroness Howarth of Breckland: That sounds quite fragmented. You've got all these things happening, with the NFU looking at the whole. How do you ensure that you get that information right across the farming community? Have you thought about using communication and technology to share that? How do you ensure that people who are not terribly ICT-conscious manage to get the information?

Helen Ferrier: As you will know, the Agriculture and Horticulture Development Board (AHDB) has lots of specific formal and informal structures to get the information out to levy-payers—workshops and newsletters and all of those kinds of things. You will always have different sections of the farming community who are more or less willing and able to pick up these new ideas, but certainly, as communication technology improves and broadband goes more widely across the country, those kinds of channels can be used. The fragmented nature of the farming industry is a challenge for lots of areas that we deal with, as well as innovation.

Q147 Baroness Howarth of Breckland: Could I move on to the CLA, because you talk a little bit about this in your evidence? We are quite interested behaviourally in how you look at the fact that some people will change and some structures will change. We are

interested in what you think in the social areas to enable people to change. In section 3 of your evidence, you refer mainly to innovation in farming which originates in the supply industries which provide farming inputs. Do you see that top-down approach as effective in terms of bringing innovation and that behavioural change? How do you ensure buy-in, so that you get it right at the grass roots, from individual farm practitioners, when you are using top-down innovation?

William Worsley: There are two questions there. I think one of the real opportunities for innovation and business change is when you get generation change in the managers of farms and farm businesses. I have to admit that I can see it in myself. I took over my farm nearly 25 years ago. When I took over, I brought considerable change and did things very differently because I was young and enthusiastic and was recently out of agricultural college. I had been working elsewhere and had learnt a lot in my professional career. I came home, took over the farm and brought in considerable change. Though I think I'm still farming pretty well and am very focused as a businessman, the pace of that change is not what it was. The real opportunity for farms and farm businesses is when you get the next generation coming in and hitting it hard, particularly where they have been properly trained at agricultural college, or wherever, and been outside and seen how other businesses work and develop. That is a real opportunity.

It's also very important that in farming we encourage people to continually develop their education. I am a chartered surveyor by profession. I have to do continuous professional development. I have to do a certain number of hours every year. That sort of thing needs to be encouraged. We should encourage farmers to look outside. Speaking as a farmer, it is very easy to sit on your farm and focus very much on your own business, becoming perhaps a little blinkered to change. That is something we want to be aware of.

Allan Buckwell: One of the levers to encourage more of that generational turnover is that there are farmers out there who are essentially retiring on the job because there is not a retirement home, so we get into social issues about affordable housing in rural areas. Those questions may be some of the blockages to the generational turnover that might otherwise come slightly earlier.

William Worsley: Thank you for coming in on that. It is a very important point about the blockage in the system. Coming on to the second part of your question about research and development, it is absolutely not just top-down. However, the cost of R&D is so great that it is very difficult for the farming industry to do it, which is why that type of innovation tends to be bought in, because the cost can't be carried by the individual farm businesses in the agricultural sector. I fully accept that that part is top-down.

However, business organisation, marketing and on-farm innovation is definitely bottom-up. If you look at business organisation, Bernard Matthews, who died last week, is an example. The Nocton dairy proposal in Lincolnshire is another example of innovation in agriculture, looking at doing things in a very different way. I appreciate that both of those have had some fairly bad press, but they are very innovative ways of looking at going forward in agriculture.

I think farmers and agriculture have done very well in looking at their marketing, the way they have developed farm shops, farmers markets and branding for local produce and are presenting their products in a far more innovative way than they were even 10 years ago. Then, on-farm, you are looking at product mixes, new crops and new varieties. An example of that is hemp. A member of ours in Essex is producing hempcrete as a very sustainable way of providing insulation. That's quite an exciting innovation. English wine is another

example, and renewables, with the way people are looking at how to do anaerobic digestion. All these are examples of farmers and farm businesses innovating.

Allan Buckwell: There is no problem about getting buy-in for the technology coming out of the agricultural input supply industries. If new machinery and new products offer advantages to farmers, as Helen said, the innovators are pretty swift at noticing it, taking it up and demonstrating that there is a benefit. In the literature I've seen, I don't think there's criticism that farmers are backward in taking up useful new technologies that reduce costs, reduce risk and improve quality of products.

Q148 The Chairman: Is there data to back that up? Do we have research data on the situation in the most efficient quartile of farm production and the least efficient, showing that if we could get broad adoption of some of the better techniques then productivity would rise across the board? Is there hard data that we can look at on that?

Allan Buckwell: I don't know of any recent studies, but over the years there have been plenty of studies, because the uptake of new technologies in agriculture is a very easy sector to study. Through the 1960s, 70s and 80s there was a lot of literature that indicated that all these theories about S-shaped innovation curves were well borne out by practices in agriculture. I don't know of any comparative studies on whether agriculture, as a fragmented, private family business sector, is noticeably worse than other fragmented private family business sectors—shopkeepers and so on—but I would have thought that farmers can demonstrate what they do. In some ways, farmers get a lot of criticisms when they do innovate. Some of the biggest innovators take the most abuse, including Bernard Matthews. Some mixed signals go out from society about how much innovation we want in our food production.

Q149 The Earl of Arran: The possibility of redundancy, for example.

Allan Buckwell: Exactly.

Q150 Baroness Sharp of Guildford: Can I raise the question of how far a sharper exposure to the market stimulates innovation? My first question is to the CLA. In your written evidence, you say that the CAP provides an important element of revenue stability, which is increasingly important as commodity markets and natural conditions are subject to greater volatility. How far do you consider that revenue stability weakens the readiness of farm businesses to adopt innovations?

William Worsley: It's a jolly difficult business to run when one year you're selling wheat for £80 or £90 a tonne, as you were last year, and the next year you are selling wheat for anything between £140 and £160 a tonne. You have seen a very interesting graph of prices of the past few years, since the single farm payment was brought in. We always believed that when the single farm payment came in there would be greater volatility in market prices. You know your cost of production. It depends on different farm businesses, but it is about £70 or £80 a tonne for wheat. It is very difficult to run a business when one year you're selling it at one price and another year you're selling it at another. I believe that the volatility in the price of agricultural products is likely to continue. Next year we are looking at pretty good prices, but I don't believe it will carry on for ever. The fact that there is support helps to put a base in so that you can keep your business going forward. For a number of years through the 2000s, farming has been marginally profitable. In seven out of the last 11 years it has lost money.

Allan Buckwell: This is a genuinely vexed question. The policy is there because farmers asked for it to help stabilise them in the face of this volatility. Does that then diminish their innovation and their tendency to respond to markets? We generally regard North America as a fairly innovative part of the world. They have a very large agricultural policy that is mostly focused on revenue stability and providing much greater price and revenue stabilisation support than we get in Europe now. That's an undisputed fact. I don't hear people saying that this has stifled innovation in US agriculture. Again, it is more the opposite: they maybe go too fast and too far for the tastes of nervous Europeans. How much stability or instability the policy gives you and how much innovation that deters is not an easy question to answer. I suspect that there are farmers who take their single payments and slide gracefully into retirement, so it could be said that this is diminishing their innovative activities. To be frank, I suspect that this group of farmers, who are in their late 50s, 60s and 70s, were not going to be very innovative whatever policy regime they were operating in. I don't think 60 and 70-year-old businessmen in any sector of the economy are as innovative as those in their 30s and 40s. Empirically, it is quite hard to demonstrate that agriculture has been tardy in taking up new technologies because it has been over-protected, but I recognise that the accusation is out there.

Q151 Baroness Sharp of Guildford: But as you say, the potential is there not just in agriculture, but in all industries. Whether monopoly helps to promote innovation or deter it is always a moot point.

Allan Buckwell: Exactly. In the pharmaceutical industry it is regarded as an essential requirement to have a monopoly for a period, otherwise you don't get the innovation in products.

Q152 Baroness Sharp of Guildford: Can I then turn to the NFU? In your written evidence, while you acknowledge the support that European farmers receive through the CAP, and while you say that most farmers are instinctive experimenters and innovators, you also warn that it cannot be assumed that innovation will happen inevitably. How far do you think that CAP support to farmers helps to explain why innovation fails to happen?

Helen Ferrier: I think I was maybe making two separate points. One can't assume that innovation will happen anyway within the whole supply chain of agriculture, including all the associated industries and the R&D that they are putting in. There have to be the right incentives and drivers. Farmers will respond to a variety of drivers—regulatory or market or whatever. Reflecting the point made by the CLA, they have to have a certain level of income or of stability in their business, as with any business, to be able to invest in new technologies or new ways of doing things, or to get interested in the latest science and so on.

There has always been this instinct to look for better ways of doing things and to improve their systems. I guess that the industry will be divided into different types of personalities that will respond to those drivers in different ways, and that will always be there whether you have support or not. Considering the kind of funding structures and incentives that come through within the common agricultural policy, there have certainly been some positive statements and desires in setting up the CAP and its various reviews over the years to use it to foster innovation and to get things moving in the right direction, but when it comes to it on the ground, and how the Rural Development Programme for England (RDPE) was structured, it doesn't necessarily happen, so those incentives and funding streams that farmers might be able to access through their RDAs don't necessarily do everything that we might want to enable, for example, funding of a business group or something like that, because they payments are there for the individual farmers and their own projects.

So there's certainly potential, but you have to be careful that you're not making some things happen and pushing the money in a certain direction that therefore doesn't allow these kinds of knowledge transfer projects to happen and people to access that money. It may be that the focus on agri-environment schemes rather than a focus on what would increase productivity and competitiveness has skewed the kinds of projects that farmers have got into. If the overall strategy was towards innovation and increasing competitiveness and productivity, you might think it would filter down through the regional funding mechanisms and the signals that the farmers get. They need some guidance on what they are likely to get funding for, to put in their application. That hasn't always been very clear, as I understand it.

Q153 The Chairman: Before we go to the next question, some of the evidence we have had suggests that the least subsidised areas, such as horticulture and pigs, have been more innovative. Do you have any views on that?

Helen Ferrier: There are definitely a lot of examples of very forward-thinking businesses in those sectors. Perhaps in some ways, in what you might call the more intensive sectors—I'm not sure that's the best term, but it's the term that people use—there is maybe more potential for putting in technologies and changing things and then looking for the impact of that change. For example, if you're running a glasshouse, you've got quite a controlled environment and you can do that kind of experimentation that I was talking about earlier. You can follow what would look like quite a scientific methodology and put in particular new technologies, cost it all up and see what's happened.

If you compare that to a hill farm, for example, it's an obvious point, but that is much more open to the elements and therefore perhaps much less able to change things and then see the result of that change and separate it from other factors. All the evidence that I have on this is my interaction with our members from the different sectors in my efforts to raise the profile of R&D within the agriculture sector and within our membership. Some sectors get the point, or it is more obvious to them to understand the link between the work that goes on in research institutes such as Rothamsted and the John Innes Centre on, for example, new varieties or identifying genes, and the things that they are using day to day on their farms—the bags of seed that perform better or the GPS in their tractor. Whereas, if you look at the animal sectors, I'm told that a lot more could be done on improving the genetics in the beef and sheep sectors, but the farmers will not necessarily have a clear idea of how that follows through the breeding and performance of their own animals. It is more difficult to envisage.

Q154 The Earl of Caithness: I'd like to move on to EU policies and agricultural innovation. I'm going to ask you both the same question. It's very easy to criticise the EU policies as a hindrance and a blockage and a bad place for companies to invest—as you have both done. If you could wave a magic wand, what is the one thing that you would change in EU policy to allow better or different agricultural innovation that would make a noticeable change, and why?

Helen Ferrier: I've got one very good example: biotechnology. As I mentioned in my previous answer, genetic improvement of crops can make a huge difference to productivity and is a clear path—although it is not always easily done—from the science to the farmer's field and the bag of seeds. We have seen the increases in productivity in certain crops elsewhere in the world due to the use of genetic modification. That particular technology will have different benefits and effects in different areas for different crops. It's not a magic bullet, but it is one example of an improvement in modern plant breeding that could give us

some of the things that we need to improve our crops and enable them to look after themselves more, which is what we want.

The potential for that technology needs to be developed and then taken up by farmers to improve their productivity, but essentially to improve the sustainability of their production. That is denied to them based on politics rather than on evidence. That is one area that would really benefit from a change. It's driven by national politics. Lots of assessment is done and EFSA does all the analysis and the scientists are rushing around doing lots of experiments and you are looking overseas and trying to monitor what has happened there, but when it comes to the actual decisions, it's politics—and that's not ideal.

Allan Buckwell: Our criticism of the EU was intended to be quite specific about the fact that the first draft of the EU 2020 strategy about smart, inclusive, sustainable growth made no reference to agriculture. This was such a grotesque oversight and omission, given that the EU runs agricultural policy, that of course this mistake had to be corrected. Our comments reflected our fury with the fact that one part of the European Union could write a document and not think to mention food and agriculture as an area, which of course has to be, can be and is, part of smart, sustainable, green, inclusive growth. We're all doomed if it's not. The criticism was entirely on that. Our example of how the European Union could do more for agricultural innovation is the same as Helen's. This is the political problem of how we persuade our fellow citizens to change their mind about their attitude to biotechnology.

Q155 The Earl of Caithness: It's not a political problem. Surely it's a problem that the scientists have utterly failed to win the arguments. They've come forward with these lovely ideas, but have not been able to sell their works as being beneficial to the community, and therefore it has appeared bad for the community. The great majority of people in Europe seem to think that these genetically modified foods are going to be bad. The press take that up and that influences politicians. It's got to start at the other end.

William Worsley: I think that a certain company that launched the whole issue of GM and the like perhaps handled it in a fairly unfortunate way and got the PR badly against it. It's been a battle from then on to try and show that biotechnology is actually a positive, good thing. Until we can persuade people to stop having a knee-jerk reaction, we are going to continue to have a problem with this. Plant breeding has been going on for a very long time. That is where we saw the huge yield increases through the 1960s and 70s. We haven't really seen the yield increases with crops over the past 10 or 15 years that we will need to find if we are to feed the world in 2050.

Q156 The Earl of Caithness: One quick question. What do you think of the idea of the European Innovation Union, announced in October?

Helen Ferrier: I think it's a very good idea. If all the sentiments that have been expressed through that can infiltrate through all the other initiatives and ultimately the decisions that are made in the institutions in Brussels, it will be very good. It's very laudable to want to position Europe as a centre for innovation across all sectors. I think it is well placed and not necessarily over-ambitious, but it needs to all fit together to come about.

Q157 Baroness Howarth of Breckland: I have a quick question about innovation. Bearing in mind the history, do you think that the science sector and the farming sector itself have learnt lessons about how to influence the presentation of innovation? We know that the Commission has recently proposed a temporary ban on the use of cloned animals for food production. There may be good or bad arguments for that. It's an early discussion. Do

Allan Buckwell: My view is probably not, because I'm not sure there is a single lesson to be learnt. These are ferociously difficult subjects. Relating to the discussion a moment or two ago, if the scientists get too strongly involved in advocacy, they get kicked to death. We are now being told that scientists overreached themselves on climate change by moving away from science and into advocacy. Had they done this on GM or use of biotechnology, I suspect they would suffer the same difficulty. This is why it is a matter of societal choice and the influence of NGOs and how the media portray these issues and the way that our political decision-making is done. I'm not at all optimistic that an innovation union for food and agriculture will mean anything when Europe has this attitude. The main science for being more precise about the way we do our animal and crop production is manipulating the genotypes of the plants and animals we're using. If we're restricted from using the fruits of the greatest 20th century innovation and discovery in Biology in this major area in Europe alone (i.e. in food production), Lord help us. You can declare whatever innovation unions you like. Unless it changes those attitudes we're not advancing food and agriculture a jot.

William Worsley: There's a fundamental fear of change among people, and it's the same in any sector, but when it comes to a sector that is producing things you eat, there's a greater fear. That's really the problem. There's a big mountain to climb. People don't like change *per se*, whatever it is, but when it comes to something you are going to eat and digest, that fear is all the greater.

Q158 The Earl of Arran: This question is for the CLA first of all. You have mentioned in some depth this appalling situation of the decline of R&D in the last 20 years. You say that it has to come from the public sector, but we all know that the public sector's going to be in a pretty poor state for the next few years. Can you see any way in which we can encourage the private sector to deliver funding for research, or is that an impossible task?

William Worsley: One of the problems with the agricultural sector is that it's a whole series of microbusinesses. That creates a real problem for the industry. When you're the supply sector to the industry, you are bigger businesses and you have a greater ability to provide that R&D. For example, there has been tremendous innovation in the way machinery has developed over the past decade, but that has come from people who are supplying to the industry, rather than from the industry itself. The key for the industry is the AHDB. The model is that the industry pays its levies and the AHDB does this work. It is absolutely key that the AHDB is enabled to deliver.

The problem with a lot of the things that are needed, the public goods issues, is that the private sector won't deliver them because there's no financial incentive. That's why the state needs to step in. It's where there is no benefit to the individual, but there is a benefit to society at large.

Q159 The Earl of Arran: We must fear where the money's going to come from to fund public sector research. It must be very worrying. Honestly, it can't go on declining like it has in the last 40 years. What's going to happen in the end?

Allan Buckwell: I hope what happens is that we're now at the low point of a business cycle, but we won't always be at the low point of it. When we come out of this recession—the Government is confident that we will and we all hope they are right—we hope that the atmosphere will change. The lessons of the 2007-08 commodity price spike and the heightened awareness of food insecurity have alerted many societies, including Britain and

Europe, to the fact that fundamental agricultural R&D had been tailing off during the 1990s and the early part of this century and those trends have to be reversed.

The messages are well understood. There is a difficulty right now in delivering on those messages because of our public finance situation, but we assume that's not permanent and it should and will be reversed. In our remarks about public R&D, we are specifically talking about the R&D necessary to help farmers to reduce their environmental impact, particularly on greenhouse gases. Breeding the animals that are going to produce less methane, finding the crops that ensure that every molecule of nitrogen that you apply is taken up and doesn't get into the water or the atmosphere—these are deeply scientific questions that farmers can't answer. It's not going to be the fertiliser industry that does that kind of research to do itself out of business. If there is not public research in these areas, it won't be done. This can be international research and it may be that we just depend on the Americans, the Japanese and Chinese. That might even be a rational strategy if they are better at it than us, but I hope not.

Q160 The Earl of Arran: Do you depend a lot on American research at the moment? Is it useful?

Allan Buckwell: It would be if we were allowed to use it, but a lot of mechanisation research certainly comes from North America.

William Worsley: On the whole issue of biotechnology that has been raised, almost all the research that has been used is American. I think I am right in saying that one of the real risks is that if we in Europe don't engage, all the technology will be owned by the Americans and that will put us in a not particularly good position.

Again, look at the technological research. I've used John Deere tractors for years because they are very good. That is American research and technology and I have to say that they are market leading.

Q161 The Earl of Arran: Just briefly, to Dr Ferrier, the CLA have mentioned the interaction of the levy and the AHDB. How can this change dramatically to make it much more effective?

Helen Ferrier: I'm not sure it has to change dramatically. It's definitely going in the right direction in bringing them all under one umbrella as AHDB. The organisation has been in a state of flux for quite a long time, and that's always difficult for the individuals within it, but there are some really good people within the levy bodies. The people are very important in this. A key role for the AHDB is to have a network of individuals who the industry can identify with and seek advice from and they can gather the views of farmers and growers on what's needed from research. I wouldn't want to complain in this forum about the AHDB as an organisation, because it has just put out its draft corporate plan for consultation and we'll be putting in our views to that. My own view, because of the areas that I cover and am so enthusiastic about, is that more emphasis should be put on the R&D and the Knowledge Transfer (KT) or knowledge exchange role of AHDB, because that is really where the market failure is and where I think we can get most improvement in profitability, sustainability and robustness for the industry. Long-term, that's where the returns are going to come from. Because of the disparate nature of the industry, which we have already discussed, it requires that kind of R&D-focused organisation that is set up to be a hub, which I know Ian Crute talks a lot about. I am really excited to look forward to the time when they are very effective in that way. I know some of the changes that have been put in place in the HDCA very recently to bring together the knowledge transfer people and the

communications people so that you can get the benefit not only of the budgets, but of the people and the skills from both those teams in the organisation. I think the network side of it is very important.

One other point about international collaboration is that some of the levy bodies are already working with their counterparts in other European countries, which is very valuable. We can't necessarily in the UK. I don't think any country should think that they should do all the research for the needs of their citizens and their industry, because different countries have different centres of excellence. Identifying and making a network of all those centres of excellence and then sharing as much information as you can that isn't commercially sensitive is a really valuable role that the AHDB can play. Obviously it is very competitive.

Q162 Lord Giddens: Professor Buckwell, you have compared the US and Europe. Could you say something about the differential role of universities in relation to R&D innovation? Is there some systematic difference in your view around the role of universities that has something to do with this?

Allan Buckwell: It's a hard one to generalise about on the European side, because different member states have very different universities.

Q163 Lord Giddens: Suppose you compare the UK with the United States.

Allan Buckwell: With the UK it's a much clearer story. UK university research on agriculture has all but disappeared. Most faculties of agriculture are now called something else.

Lord Giddens: We had previous evidence about that. It's one of the reasons I'm asking the question.

Allan Buckwell: That is in stark contrast to the US land grant system. Some of the key innovations and scientific discoveries in agriculture during the last century have come out of that land grant system. The UK had a system which could hold its own with the United States and has largely changed it by the signals it gave to its academics. I think you know what I'm talking about—the research assessment exercise and the focus away from near-market or industry-related research. That has been an issue, but it's not repeated across the rest of Europe, which is why some of the strongest agricultural research university systems, in the Netherlands and France, for example, haven't taken the route that the UK did.

Q164 Lord Giddens: So they are well in advance of the UK in terms of best practice?

Allan Buckwell: I don't want to denigrate my colleagues in the UK who do amazing and fantastic research, but they are following the signal—

Lord Giddens: I am asking about structures, not individuals.

Allan Buckwell: Precisely. Wageningen University in the Netherlands is one of Europe's worldbeaters in agricultural research at every level, from the pure scientific down to the applied and the knowledge transfer. They have an admirable system.

Q165 Lord Giddens: Is that because agriculture has more appeal to students than it does here? This issue was raised in several previous sessions. It has only recently started to regain appeal in universities as it converges with climate change and the other issues that interest the younger generation.

Allan Buckwell: Yes, and in the Netherlands agriculture is a much larger part of their economy and their exports than in the UK. There is quite a big collection of factors of that kind that explain why agriculture in Britain is in the state it is in the universities.

Q166 The Earl of Caithness: I have a quick question for Dr Ferrier. I don't want you to answer it now, but I'd like you to write and give us further information. If you think the AHDB is so good and is doing a useful job, what organisation is going to do that job for farmers if it is abolished under the Public Bodies Bill?

The Chairman: We look forward to receiving that.

Q167 Baroness Sharp of Guildford: I was going to ask about the co-operatives in New Zealand, which have played an important part, particularly in the dissemination of R&D. It's quite an interesting country, because it has been very much exposed to the market and had to stand on its own feet. It has pulled up its agricultural sector by its own bootstraps. I wondered whether there were lessons to be learnt from that.

Helen Ferrier: I'm sure there are. I don't know a great deal about the intricacies of how knowledge transfer and so on works in New Zealand, but one can certainly see the forward-looking and innovative ways in which the sectors are improving.

Q168 Baroness Sharp of Guildford: Co-operatives don't play much of a part here in the UK. In Denmark, for example, they still play a very substantial part, and in the Netherlands and France.

Helen Ferrier: There is certainly a power in being able to work in that kind of co-operative manner, because it somehow reduces the risk to an individual of making a change. In science there's always a benefit of having more data, so one of the values of having European-level research in the framework programme is that you have the possibility of having much more data. If you can do that at farm level and get people together and get them to compare with each other - in a competitive way in that everyone wants to be the best, but not in a competitive way in trying to get it to the markets, I'm sure there are things to learn.

Q169 Lord Cameron of Dillington: I wanted to look at European Union research. The framework programme has a lot of money going into research, of which a small percentage goes to agriculture. The CLA says that it is high-level, broad generality, high-risk, long-term horizon research. I'm not sure whether that is a criticism or whether you think that's exactly as it ought to be. You indicate that the more applied research should be at a member state or lower level. Perhaps you could answer the question. Is that a criticism? Should EU research be organised differently?

Allan Buckwell: It's not intended as a criticism. Because of the process and the fact that a lot of it is collaborative across research institutes and member states, it inevitably takes a long time to have the calls for proposals, the judging process, the initiation, doing the research and then the dissemination. That takes many years, so it can never be a vehicle for answering next summer's problem between now and then. It's simply not geared up to do that kind of thing. Looking at some of the words we used, I would have written it differently if I had spent a little more time. I didn't want in any way to convey that there was no utility from this research. This is important collaborative international research of high quality. I am now more aware, because I have spent a little more time digging around, that the framework programmes are trying their hardest to get the involvement of industrial participants, in particular SMEs, and they have a number of projects where they have tried to do that. I think there is a commendable awareness within that system of trying to engage the potential users

of the research, although I am interested in seeing the outcome of the “diet and prevention of functional decline of the elderly” research project that is going on at the moment! I may be in need of that one. It was more a comment on the fact that these are inevitably long-term projects and not shorter-term, quicker turnaround answers to practical problems of farmers.

Q170 Lord Cameron of Dillington: Should they be doing more to work across member states and universities, or putting funding into other areas? I am talking about moving down to more near-market research in some way.

Allan Buckwell: Because it's inevitably quite a protracted process bringing that collaboration together, I'm not convinced that that is the right approach for the more applied work. In agriculture, part of the reasons why you need it is to adapt to local conditions, which are very variable. We can't expect Hungarian research to be all that helpful to British cereal growers, although they do excellent work in Hungary. Because of those sorts of differences, I don't see the case at the applied level for major, further collaborative European work.

Q171 Lord Cameron of Dillington: Dr Ferrier, you think there's great potential for these funds to be used for better productivity and competitiveness.

Helen Ferrier: Well, it's a big pot of money. The scientists in this country are always looking for money to fund their research. That's their job. If improvements can be made in all the bureaucracy and administration around accessing the framework money, that would be very beneficial. I know from looking at the consultation that's open at the moment on the Framework Programme 8 planning that this has been acknowledged by those who are looking to put together the next framework programme, although I imagine they were also looking at that when they were planning Framework Programme 7. There is always going to be a certain level of bureaucracy around research funding, because you have to account for the money as it's spent.

I was at Rothamsted yesterday. I know you've heard from Professor Moloney. The kind of international collaborations that they get involved in there have the potential to access not only money, which keeps a research centre or department going—obviously you don't want to keep something going if it's not useful, but they need a certain amount of money—but also the best science that is being done around the world. In the farming industry we need to make sure that we are heavily engaged with the scientists to make sure that in each sector we know who the key scientists are who are doing the research and we enthuse them by talking about how interested we are in the potential for their research to make a real difference to British farmers - so that is therefore what they want to get out of a research project. Although in the past the direction of flow in terms of fundamental understanding and more applied and translational research has been from countries like the UK and the developed world to the developing world, we can learn a lot from the kind of research programmes happening in Brazil, India or China and get benefit for us. What we don't want is that we as taxpayers pay for all the fundamental stuff, ship that over for free—because it's publically funded—to someone in China, the US or Brazil who then turns it into something really clever that improves their competitiveness and then we buy back the products with the added value. That's not ideal. From European funds we want a robust, focused agricultural research capability in the UK, sharing a lot of the expertise around the world, and certainly within Europe.

Q172 Lord Giddens: My first question is for Dr Ferrier. I'm sorry if you feel a bit overworked here. You may feel it has been largely covered, because it is essentially about

knowledge transfer. Comments have emerged in lots of the discussions we have had about the barriers to knowledge transfer from innovation to practice. I wondered if you wanted to comment any more on that, or give one or two specific examples of best practice.

Helen Ferrier: One point about knowledge transfer that I might have made in my written response—apologies for the repetition, but it is quite important—is that when we are looking at the kind of research that industry might do and the things that we want from agricultural R&D, if you have a technology that you are going to sell, like a GPS system, a new crop variety or a new pesticide, the knowledge transfer is relatively simple when you get to the end point, because the farmer will buy the kit and use it according to need. The distributor will give some advice on how to get the best out of it, hopefully, but you also need the management side, as I said before. For those things that aren't a product, who is doing the knowledge transfer? Who gets the returns on their investment and all the resources that they put into knowledge transfer when it's a management practice?

An example would be soil management, which, depending on your type of soil, covers issues such as when you go on with your machinery, at what point you do your cultivation and even what crop is best to put in your rotation and what kind of rotation you should be doing, at what point you might irrigate if it's a potato crop for example. On those kinds of management issues, who gets the benefit of selling that advice? The interaction between the advisory sectors—the distributor-type consultants and advisers and the independent agronomists or nutritionists—and the science community is very important so that they are questioning their own advice and basing it on the latest knowledge, and so that farmers are able to question and challenge that advice and don't just take it and expect to be told what to do so that they can go off and do it. There is that exchange. You can change from it all being about knowledge transfer to being knowledge exchange. It's a bit semantic, but that two-way dialogue would be valuable for everybody.

The point is that there are so many different types of people in farming and they will need knowledge transfer and exchange in different forms. We have already covered it in terms of electronic communication and so on, but you need a combination ranging from newsletters all the way along to one-to-one. It has to be a mixture, because it's never going to be one size fits all.

Q173 Lord Giddens: The idea of an interaction on a biological model is really important, these days especially. Can I turn to one final question, which again you might think has been covered? One of the aims of the Committee is that innovation shouldn't be understood as just technological innovation, but covers social and economic innovation, which is also important. You mention a discussion of new models of business organisation and joint venture. I don't know if you'd like to expand a bit on that as an example of innovation that is not simply technological, but covers a broader notion of innovation.

William Worsley: I think that business innovation and structures are equally as important as technological innovation. We talked about co-operatives a minute ago. Traditionally, in this country there has not been a strong culture of co-operatives in the farming or forestry industries. That's a pity, particularly on the latter industry, because there are an awful lot of small producers who won't talk to each other. If they got together and worked together, it would be hugely better for the sector. When the timber growers' organisation was set up in the 1960s, part of its remit was to deliver that.

Q174 Lord Giddens: Can I just interrupt? There are plenty of other countries where that's not the case. That includes the US, incidentally.

William Worsley: Absolutely right. If you look at continental Europe, in France or Germany—again touching on forestry—or even the United States, there are tremendous examples of co-operatives. One thing is to try and encourage our farmers to work better together, but it's a challenge. They don't do so naturally. It's also geographically quite different. In East Anglia, farmers are much better at co-operating and working together with various forms of farm structures, whether it is contracting—whole-farm or operational—or farm business tenancies. Those are the ways forward.

Also, where a lot of businesses are perhaps too small to be viable, the owner of such a business could be encouraged to look at it as a businessman and perhaps to joint venture in different ways with other farmers, whether it is getting your neighbour to do the farming for you or whatever. Looking at your land ownership is one part and looking at your farm business is another. I come from a business background and I look at my farming operation as a business. That's very important and it is something we need to encourage farmers to do. I have touched on generational change. That is very often when the younger generation, being encouraged by dad or mum to come back and take over the farm, looks at it with a more objective view than perhaps his father did and looks at the way the business is structured. We have to look at farming as businesses, in exactly the same way that you would look at any other business.

Q175 Lord Giddens: It's interesting, because there is a return of the dialogue of mutualism in politics generally at the moment, which has been picked up by all three major parties. Maybe that can feed into government policy somehow.

Allan Buckwell: In recent years we have created an organisation called the English Food and Farming Partnership, whose job was to try and promote farmers working together horizontally and vertically in the food chain, and they have some outstanding success stories. We haven't been doing nothing on this. We are very conscious of the points that Lord Giddens made, that British agriculture has been less keen or willing to get into co-operatives than on the continent. There have been serious efforts to do something about this, and some signs of success. It would be worth getting some of their examples.

Q176 Lord Giddens: I meant some of them could be taken directly to the Government, because this is part of their outlook on the world, really. I think it's not without significance that the general way in politics at the moment is that people are looking for something different from traditional state ways of doing things and the somewhat discredited naked market model way of doing things. In so far as you could bring that into contact with these wider discussions, it might be very helpful for farmers and provide resources. The Government supposedly have resources.

William Worsley: What is important is that there is flexibility of structures in the farming industry. We need to encourage people to get together and come up with the best structures for their particular businesses. Very often it's collaboration with others. Through freedom of contract, we want to encourage grown-up businessmen to work together to create the most effective and efficient forms of farm management. That involves environmental management and stewardship as well as pure production. I think that's very important.

Q177 Lord Cameron of Dillington: Dr Ferrier talked about the AHDB and her non-criticism. I wondered what the CLA felt about the role of the AHDB.

William Worsley: We think the AHDB is extremely important. They have had setbacks. We meet with them. We think they are really important. The change of chief executive hasn't helped, along with the fact that they haven't been able to relocate to a proper, efficient office structure and the problems they are having with that. They need to be encouraged and supported. There are some very good people in the levy boards and it is the one real way that we feel this research can be brought to the industry.

Q178 Lord Cameron of Dillington: So they should be doing the agricultural extension. What other methodology could you use for agricultural extension?

Allan Buckwell: They are vital in the knowledge transfer process. There is no doubt about that. We would be horrified if the review puts any doubt whatever over the existence of the AHDB and proposes anything other than how we can help them come into being as fast as possible and be as effective as possible.

The Chairman: Thank you very much. You have given us a lot to think about.

William Worsley: Thank you for inviting us.

Helen Ferrier: Yes. Thank you very much.

Supplementary Memorandum by the National Farmers Union (IEUA 34)

Follow-up questions

1. Because of shortage of time, it was not possible to bring into discussion the final question in the list previously sent through: "The CAP requires Member States to set up a Farm Advisory System, which can be at least partly funded through Pillar 2. How well do you think this requirement is being implemented in the UK and throughout the EU? What more might the EU do to improve farm advice?"

The FAS was in fact set up in England to increase farmers' understanding and compliance with Statutory Management Requirements and GAEC conditions under cross-compliance. It was not set up to be a vehicle for delivering support for innovation or adoption of new technologies and practices. We do not expect the FAS to be widened to include this type of farm advice.

The advice in England is currently delivered through Momenta. Its contract will end in March 2011 and we do not know what or who will take over delivery thereafter, as the decision has yet to be taken by Defra. It focuses on cross compliance implementation rather than industry-wide activities such as knowledge transfer.

So farm advice for knowledge exchange, knowledge transfer and innovation does not fit well into this particular mechanism and should be strengthened at a European level through other channels. In particular, R&D programmes should ensure that KT and KE with farmers and with the farm advice and consultancy sectors are an integral part and requirement of any agricultural research project. There must be sufficient financial support for this within research budgets, perhaps with some specific funding streams dedicated to these activities. Sharing best practice between member states and making the most of particular national expertise would be helpful and the EU could create effective networks and forums to facilitate this (this may already happen to some extent).

2. If the AHDB were to be abolished under the Public Bodies Bill, what organisation should take on the useful work now being done by the AHDB?

The NFU, as a membership organisation, has a policy making structure involving elected members, to discuss and decide the organisation's position on key issues. The Committee will therefore understand that the hypothetical question of the abolition of AHDB is difficult for us to answer without having this debate internally. We can say, however, that the NFU would not be in favour of AHDB being abolished. Therefore the following comments reflect my own initial thoughts on what the possible alternatives would be in this hypothetical situation. I will limit my answer to the R&D and knowledge transfer (KT) roles of AHDB as that is most relevant to the current inquiry.

A mechanism must be available for the money that farmers currently pay as a levy to be still be available and spent on agricultural research. The market failure that justifies the existence of AHDB will still remain, and the need for industry-focussed research and for KT is increasing, so I believe there would be a strong argument for this kind of work to continue. This could be achieved through establishing specific centres for each sector linked to universities, research institutes or colleges depending on where the expertise is. There are already groups in existence that work closely with levy bodies and independently on R&D

and KT for farmers at various levels e.g. Rothamsted Research Association, East Malling Research, Harper Adams University College etc.; and new initiatives being set up such as the North Wyke Farm Platform, and a new 'centre of excellence for UK farming' at University of Aberystwyth.

However, the value and opportunity of the new AHDB structure is that the levy bodies have been brought together both organisationally and geographically. It would be a great shame to lose this. So there would still need to be a central body to coordinate activities and networks and to facilitate the projects that address cross-sector issues such as soils, nutrient management or climate change. It is critical that any arrangement operates a very effective network and enables farmers and growers to identify and engage with the people and the places that are doing R&D and KT for them. The importance of key individuals in driving forward projects and establishing networks cannot be underestimated.

The Bioscience Knowledge Transfer Network model under the Technology Strategy Board offers another model for research-related activities delivering benefit to industry. Of course it does already encompass agriculture but is very much less known in the farming industry compared to the more established TSB industry sectors. Any organisation involved in agricultural R&D and KT should make the most of the KTN and explore ways to integrate its activities.

I think there would also be a role for representative organisations such as the NFU in signposting, enabling and delivering R&D and KT, including the use of outsourcing and government support. However, the Committee will appreciate that membership organisations do have to be able to offer services exclusive to their members, given that they are generally funded entirely by subscriptions. Having said this, partnerships with government and other organisations can certainly be a useful mechanism for enabling innovation in agriculture.

The need for knowledge exchange mechanisms that I talked about in my written and oral evidence would be very important for any research body, as it must be for AHDB. R&D focussed on industry need is vital if necessary gains in both productivity and sustainability are to be made. And this requires genuine, effective and sustained knowledge exchange between science community, advisory sectors, farmers and wider agriculture industry.

US Department of Agriculture

Oral evidence, 1 December 2010 (pm), Q 179-197

Evidence Session No. 5. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
Lord Cameron of Dillington
Baroness Howarth of Breckland

Examination of Witnesses

Witnesses: **Dr Roger Beachy** [Former Acting Chief Scientist and Director of US Department of Agriculture's National Institute of Food and Agriculture] and **Mr Jack Bobo** [Senior Advisor on Biotechnology, US Department of State] via videoconference.

Q179 The Chairman: First of all, Dr Beachy and Mr Bobo, thank you very much for agreeing to give us evidence. We really appreciate you taking the time to do that. If that's okay, I shall just deal with a couple of formalities. The House of Lords is currently in session and a large debate is taking place. If at one moment you hear some bells ringing, I shall have to get up and go and vote, but two of my colleagues, Baroness Howarth and Lord Cameron, will continue, and we may be joined by one of our other colleagues later as the vote progresses. I'm sorry to put that bit of colour into this meeting.

The formality of it, if I may get that started, is that this is a formal evidence-taking session of our Sub-Committee and a full transcript will be taken. That will go on the public record and on the parliamentary website. We will send you a copy of the transcript and you can correct that for minor drafting errors. The session is on the record and is being webcast live. That will be accessible on the parliamentary website.

Could we ask you both to state your names and positions and then we can move on.

Dr Roger Beachy: Thank you very much. I am Roger Beachy, the director of the National Institute of Food and Agriculture, or NIFA. NIFA is the agency in the Department of Agriculture that is responsible for providing competitive research grants and formula research grants to our universities around the country. We are in a mission area called REE—Research, Education and Economics. I served as Acting Chief Scientist of the Department from January until very recently.

Mr Jack Bobo: My name is Jack Bobo. I'm the senior adviser for biotechnology at the US Department of State in the economic area.

Q180 The Chairman: Thank you. You probably can't hear that bell ringing in the background. I have a couple of minutes before I have to dash down the corridor. Would you mind giving us some background observations before we move to questions?

Dr Roger Beachy: Just a few. Many of my science colleagues are in the UK and I have been in contact with them for a number of years at the John Innes Centre and other places, including Rothamsted Research and some of the universities. My background is in science and technology. I have not been in the private sector – having always worked in the public research sector. My prior roles have allowed me to play a part in bringing science to a level of visibility and impact in our US Department of Agriculture. We feel that the importance of science and technology going forward is that we cannot achieve our US goals or the ‘grand societal challenges’ without engaging agriculture. We are heavily committed to the role of science and new technologies as we face the global societal challenges that rely on food and agriculture.

Our Secretary of Agriculture Vilsack has made this plainly clear as he came on board. Agriculture is an important component of the American economy. Today we learned of a report indicating that the value of US export trade for agriculture is about \$125 billion in this calendar year. The economy has weak points in other sectors. If we are to continue this kind of activity and value we will need the best of science, the best of technology, the best of environmentalism and the best of economics put together in a systematic approach if we are to have a sustainable agriculture that will take us through this century and into the next.

This is a science-rich administration and a Department that has placed a higher visibility and greater emphasis on science than perhaps in previous years. I am very pleased to be able to be here today with my colleagues. We have a lot of experiences that I hope will be useful in your evidence-taking.

The Chairman: Thank you very much. I shall ask Lord Cameron if he will step in while I go and vote, then I shall come back and join you.

Q181 Lord Cameron of Dillington: Thank you for that introduction. We totally agree with your emphasis on science promoting agriculture. You in America have slightly larger farms than we do here, but nevertheless, very few farms could get involved in research. Is there any form of levy that farmers might pay into some body that encourages agricultural research, or is it all done by the public sector or the big five or six companies?

Dr Roger Beachy: The science that feeds agriculture in the US is sponsored by the Federal Government through the US Department of Agriculture, but also through the National Science Foundation, the Department of Energy. Some of the fundamental work is sponsored by the National Institute of Health.

In addition to those sources, there are opportunities for other research grants that come through the private sector. We do not have a tax on farming per se, but there is a check-off mechanism through which a levy on some of the major crops support research in universities and other institutions. These check-off funds that are collected from a community of soybean growers, maize growers, cotton growers and perhaps other groups. Funds are collected and through a variety of priority setting process and funding strategies, are used to conduct research that would benefit local or national goals. For example, soybean growers in the State of Missouri disperse funds for research on soybeans made available through a national program, selecting research projects that they think will bring value to Missouri soy producers. This is repeated around the country, with different crop programmes providing resources for studies on their crops. In general these programmes are more common among the large acreage crops than for horticultural crops. Nevertheless, having such funds available for research enriches the federal budgets for research.

Research contracts may also come from seed companies, technology providers, and other private sector source to support fundamental as well as translational work in the universities; companies such as DuPont, Monsanto, Bayer, and others have such programmes, although at levels somewhat lower than in the past. I believe that similar arrangements have been made at the John Innes Centre and various Universities in England for a number of years, to the advancement of science.

Q182 Lord Cameron of Dillington: What about agricultural extension? Again, emphasising the small farms versus larger farms that you have, is it easy getting the knowledge out from these diverse universities and academic centres, or are the big five—Monsanto, DuPont, Syngenta, etc—the main conduit for the information?

Dr Roger Beachy: As you may know, the Morrill Act of nearly 150 years ago established the land grant university system in the US. From that time onward there have been other Acts of Congress that established mechanisms for transmitting information from universities to farmers and others in the food and agriculture sector. These extension services as they are called, have played a tremendously important role in the success of American agriculture. There was a time—and this still happens—when there was an extension office in every county in every state. I think they are now fewer than in every county, but nevertheless there is a county extension agency that is an arm of the land grant university in each state. Funding provided from the federal Government through NIFA makes possible the support of some, but not all, of the activities in those county agencies. The state normally put in some funding, and there might be some other private or local public funds that go into such programmes.

Those programmes would be different in different settings. For example, an extension agency in an urban setting might place, emphasis on addressing issues such as childhood obesity through education; or helping a mother to learn how to handle her finances; or they would also be responsible for implementing the 4H youth programmes. Several million of our youth annually participate in the 4H programmes. An extension agent might be responsible for helping to establish an urban garden programs, or to develop, a small farming operation to serve a local market.

Certainly in the rural settings extension offices conduct somewhat different work, perhaps a program to teach energy efficiency; or to teach beginning farmers and ranchers to begin a new farm; or working with individuals who want to begin an organic farm, or transition from one type of agriculture to another. Indeed, my agency has grant funds available (in a competitive manner) that strive to learn how best to assist new farmers to be financially successful.

There is currently a very strong emphasis and focus in this Department on establishing new farmers and helping to create an environment that allows them to be successful. We have lost many, many farmers as farming has gone through its many changes: attracting them, or their children back to be successful businesspeople is not an insubstantial challenge. A lot of education and research are required to know what would work in one setting versus in another. We see this as part of research, part of education and part of extension, all of which is sponsored by the National Institute of Food and Agriculture, or NIFA.

Baroness Howarth of Breckland: You have talked a lot about a series of complex grants and subsidies that are being put in to enhance and take forward many new projects. We had a series of discussions with other witnesses about whether subsidy payments serve as a positive lever or whether they cushion farmers so that they don't take the risks that they might in the future. The other argument we have heard is that farmers find it quite difficult

to take risks, because crop failure could mean business failure, so sometimes it needs government intervention to help with that risk. Do you have a view about the balance between subsidy and the levers that make business move forward?

Dr Roger Beachy: The issue of subsidy is not something I'm comfortable talking about. I'll turn that over to others around the table if they want to add anything. Our role is primarily to identify the challenges to agricultural success and to use what methods we can, either directed by Congress or through our existing programmes, to create the knowledge base necessary to encourage success. We have block-grant programmes in other agencies of the department that are available for farmers and other rural businesses to use, either as grants or loan guarantees. A new farmer might need it, or a transitioning organic farmer might access it.

With regard to how subsidies work and whether they encourage or discourage agriculture, I will ask for input from others round the table, because that is not my forte.

Mr Jack Bobo: I think it's probably better if we check and see if there is some additional information that we can provide at a later time. I don't think any of us at the table are experts in crop insurance and some of the other subsidy programmes.

Dr Roger Beachy: I would like to comment on your question about risk-taking. Farmers in the US are pretty entrepreneurial. They look at advances in technology with an open eye. In some cases our land grant universities and extension specialists, or representatives of the private sector will create demonstrations of new technologies for farmers to see and use. Farmers will follow the lead if they think they have a good chance of success. They may not engage all their land in a new process, of course. Any good farmer will hedge their bets in the first year or two and then move over to adoption. The farmers have choices of methods of production. In many cases they look to the private sector for information, in particular those from which they purchase seeds, crop chemicals, or equipment. My point is that farmers no longer look solely to the university; they look for the source(s) of best information for their question. It might be a dealer down the street who sells their equipment as well as their seeds and fertilisers, who might have a specialist in residence who would help them to diagnose diseases or diagnose problem with their soil. In other cases they will look to the extension agent or to the private sector to provide that information. Some states have quite a robust business for services that can be provided to the larger farmers for a fee. In some cases, farmers will band together and pay for a consultant.

Q183 Baroness Howarth of Breckland: We are interested in the link between the behavioural sciences and your pure science. Translating scientific knowledge into practical operation on a farm is quite a few steps. You mentioned some of those when you were introducing it. We just wondered if in the States you had any more definitive information about what enables people to innovate and move forward. We have had some indicators that sometimes its youth—young farmers might be more likely to adopt innovations. We have quite an ageing population of farmers in the UK. Sometimes it's simply, as you say, being able to be exposed to new products. We were wondering in our discussion this morning whether there was any research or information that helped with those kinds of indicators.

Dr Roger Beachy: Indeed there is, and we should maybe make some effort to provide you with such. The Economic Research Service, which is a sister agency in this mission area, conducts studies of that type about what makes economic success or failure in an agriculture setting. We could make examples of such studies available if you wish. Dr Kitty Smith is the director of that ERS. They are a valuable resource for us; for example, the ERS can help us

to know how well, or poorly, our research, education and extension meets the needs of the farmers. The ERS covers many topic areas, of course. The social sciences are a very important component in agriculture success, of course.

It might be of interest to know that in the most recent iteration of our call for research grants, I have asked for teams of scientists to work together to address the needs: this would require bench scientists to connect to the translational scientist, to the field scientist, to the social scientist who would implement the outcomes of that research. We have even asked that the potential user influence the decision of the researcher on the choice of research project that would be most beneficial for agriculture. Most of the teams are comprised of scientists in universities who have been very proud of their individual work in fundamental sciences, say in genomics or proteomics or some of the sciences that are considered cutting edge. By involving themselves in teams they are finding real value in knowing who is going to use their information. By connecting to social scientists and real-world uses this has really informed their process of applying for grants.

Through this process we are awarding larger grants that are team-based, with teams made up of scientists from multiple states, because many of the important questions in agriculture are regional issues, not simply local issues. This 'systems approach' to agriculture research and development and implementation is new. I am very pleased that in the last year or so, we have managed to help to change a lot of attitudes about problem solving in agriculture. There are some individuals in universities who don't like the approach, but we think this is what agriculture research and education needs. We need the best brains and the breadth of intellect and multiple inputs to have successful agriculture. It is not just the big companies or farmers, or the little companies and farmers, and not just the researcher; it is a real continuum of intellectual and technical input that we will rely on. As our Secretary reminds us, success in agriculture is all about getting along—the big farmers, the small farmers, the biotech farmers, the conventional farmers and the organic farmers. We need to learn how to do this together so that all the economic sectors and all those producer types can be successful. We need the social science to help us to know how to get there. My agency includes a number of social scientists and I have been convinced by them and by others that this is an important approach. Thanks for the question.

Q184 Lord Cameron of Dillington: That picture of your agricultural extension operation is very impressive. We are very clear in our own minds that agricultural extension is probably more than half the battle, as opposed to pure R&D. Getting the information on what the land managers and farmers want back to the research scientists is equally as important as the other way round. I was just wondering about the cautions that might be involved. Farming and land management now is a much broader concept than it used to be 25 years ago, in terms of pure food production at all costs. Obviously the environment and other aspects—we have mentioned the social aspects—come into it as well. What part would the environmental consequences of new methodologies play in the feedback that farmers in the States might be giving back to the research departments?

Dr Roger Beachy: That's another good question; environmental stewardship is a critical component of our present and future success in agriculture. We know that we must have sustainability in agriculture, including sustaining our natural resources. Over the years, the small and large farmers have become aware of the important issues in American society—clean water and natural resources that are available for them to see and enjoy, as well as for the farmer to use and generate profits. In the last 10 years, we have seen a noticeable difference in the types of practices that our farmers are using as they work to restrict soil erosion, the contamination from animal agriculture into water streams and other

environmental challenges that are common to agriculture. Furthermore, natural resource preservation and management is a very important part of what the Department of Agriculture does. The USDA includes scientists who focus on natural resource management and are responsible for ensuring that practices and policies are as good as possible. We let that help to guide our directions for the farmers and producers as we make recommendations that they need to implement.

At this point in time, we don't have a sustainability 'certificate' for our agriculture, and perhaps we will not; nevertheless the idea that everyone is responsible for the sustainability of their agro-environment is infused across the agriculture community. It is not the case, as is often portrayed by some of the critics of US agriculture, that we really don't care about natural resources; we certainly do. The USDA pays a great deal of attention at the local and regional level to natural resource management. If not, we know that our success in future will be restricted.

That brings us to a challenge in agriculture, because we are asking our lands to produce more food - without using more land. We have a footprint of high-value agriculture land; we have other lands that have been considered marginal. We know that some marginal lands can be brought into higher productivity with good soil and water management. In fact, some of those lands might be useful for the production of biomass; which will be part of the solution for producing biorenewable transportation fuels and biopower.

As we see the need to alter the footprint of agriculture, we have at our disposal a variety of relevant new technologies as well as older technologies that can be brought to bear on the challenges, such as - crop rotations, soil management strategies and no-till agriculture are very important parts of the solution. Some of these practices have been made possible by the new technologies such as herbicide-tolerant crops that have been developed for use in the US. These practices are part of the plan to provide additional protection to our natural resources, which are so vital in agriculture. How the practices go together is a puzzle that is largely managed by the farmer. He or she will make those decisions.

Q185 Lord Cameron of Dillington: Of course, the ultimate end of the R&D pipeline must be the consumer. In your process does the consumer have a say, in terms of a caution or an encouragement, in what's going on? Are they involved in the whole process?

Dr Roger Beachy: Yes, there is a large amount of stakeholder input in developing the processes that will form the basis of agriculture into the future. I'll take my own agency as an example. Each year, we have stakeholder listening sessions in which a single farmer or a group of farmers, or scientists, technology companies, policy makers provide statements or make presentations to describe the challenges that they face and request that we conduct research and education programs that will address the issue. In this manner they have input about our grants programmes. Likewise those same groups will go to Congress and request help in solving the issues that are important to them. With regard to what technologies might be useful, we also listen to the consumers, from the woman who buys the food to the grower who would produce it on their farm. I was at a meeting this morning when someone said that the record for the number of comments on a given issue is something like 250,000. There is a lot of listening going on in our Department.

Q186 Lord Cameron of Dillington: We have five or six very large retailers who say they are the voice of the consumer because they do a lot of market research. They also influence the way we behave on the farm and up the R&D pipeline. Is it the same in the States?

Dr Roger Beachy: We listen to individuals as well as a wide range of individuals as well as a wide range of individuals, many of whom represent various parts of the private sector. Nevertheless, we always recognise that every sector, whomever they represent, will present things through their own filter. Our Economic Research Service is an independent research agency that conducts many of the surveys related to food, agriculture, natural resources, among other topics, on behalf of the Department. This gives less filtered information. What guides them should be the science that comes from the agriculture researcher and from the economic research scientist. Looking at the importance of the scientific outcomes, we place those surveys, the researchers and the seed companies all in the same basket and use those to help to establish policy.

Q187 Baroness Howarth of Breckland: Can I just ask another question here? We in Europe have come rather unstuck with some of our consumer groups. I have mentioned the GM question in particular, where the European Community has in my view failed to look at the research objectively and has come to conclusions driven by particular lobbying groups. That is likely to happen with other new technologies unless scientists find ways of presenting the information differently and engaging consumers on a different level. Do you have any advice for Europe about all that?

Dr Roger Beachy: I have some advice, but it probably won't be taken. I'm only kidding. We in the US consider the issue in a not dissimilar way to how you described it. The importance of communication from researchers in this and other fields to the public has never been more critical than it is now when introducing the new technologies. If we look forward beyond biotechnology to the use of nanotechnology in agriculture and health, or new technologies that we don't yet know about, we need to find ways to make their use non-threatening to the public and to provide a full and complete picture to those who will be the beneficiaries. For example, it is recognised that consumers have generally not been provided with a risk-benefit analysis on new products or processes, including in the food and agriculture sector. It is usually the scientist who helps to make a discovery, or has studied a new technology or product who conducts such studies. For example, if scientists who conduct such analyses of a new technology that, is likely to reduce the use of agricultural chemicals, would reduce loss of topsoil and to result in improved, water quality, acceptance of a technology or product might be enhanced. By having independent analyses conducted by informed unbiased university scientists, many of whom have over the years been trusted by our public, there may be more rapid uptake of new technologies.

One of the things that comes up in my discussions around the US is that a number of individuals interested in communications are asking why we have not trained our scientists to be better communicators. That's a new thing for us, too. Some are better at it than others, it's worth investment to train communicators. You have some outstanding scientists and communicators— Sir David Baulcombe, Sir Gordon Conway, and Chris Leaver are excellent examples; the now deceased director at the John Innes Centre, my friend Chris Lamb was a very good communicator of science discovery. These guys are/were also outstanding scientists. They know about communication. There are some of my colleagues who I wouldn't want to put in front of a camera, let alone a group of individuals; but there are many who can be good voices. I hope that we can work more towards that end, because the voice of science, much of which comes out of our universities, is often the most trusted. I urge you to do it, even to the point of helping universities to fund training in communication providing resources or having it as part of the grants programme of training in media. Success in technology adoption is often about media and about marketing the

information in an effective way. Certainly, the anti-biotechnology advocates have been more effective than have the pro-biotechnology advocates.

Mr Jack Bobo: If I could just add something quickly, I have been working on biotechnology for the last eight years and I certainly know the challenge here. One thing that I have found is that you can explain the science and talk about the safety, but even if people are 99.9% sure that you are right, that's still not a reason to want it. If we are not able to provide reasons why it's in the consumer's benefit to accept these new technologies, we've lost before we've ever started.

This takes us back, in some respects to the problems created by agriculture—run-off, erosion and pollution. Those are also problems for farmers. If there's nitrogen running off into streams and lakes, that's wasted product. When we talk about science and technology, the farmer wants these new technologies because they reduce their inputs and increase their incomes, but they also have a positive impact on the consumer and on the environment, because they use fewer pesticides, we have nitrogen-use efficiency in crops, we have drought-tolerant crops. All these things benefit the farmers. They are willing to pay for them, but the consumers get positive externalities.

So, as we look at issues like climate change in particular, that's a challenge that we all face, and the issue of agriculture is certainly part of that. 32% of greenhouse gases come from agriculture and forestry, and only 26% from the energy sector. Much of deforestation is caused by agriculture. When we start to look at the opportunities, we need to increase the profile of agriculture generally, but when you start looking at how agriculture contributes to mitigating climate change, the cost of mitigation in agriculture is less than doing it through the energy sector. It's a cheaper part of the solution and a bigger part of the problem. I think a lot of it has to do with how we communicate these issues to the public. Farmers pay for the technology, not the consumer, so it's not about using less energy or paying more for it; it's about getting cheaper food and allowing the farmer to do what the farmer does best.

Q188 Lord Cameron of Dillington: Thank you for that. On the same theme, in terms of consumer confidence in products, I wonder whether you could say a little bit about your regulatory system and how a chemical is given a licence to produce and to market. In that vein, one of the rumours that was circulating in Europe at the time of the first hoo-ha, if I can call it that, about GM crops was that there were Monsanto scientists—or maybe ex-Monsanto scientists—sitting on the board that was assessing the propriety of the products. I'm sure that is probably entirely fallacious rumours, but it would be interesting to hear your comments on that.

Dr Roger Beachy: You asked first about agriculture chemicals. I am more comfortable talking about the new agriculture products, such as the new seeds. Would that be okay? As you know, the development of the regulatory framework began in the 1980s and resulted in the creation of a tripartite programme that would assure environmental health, consumer health safety as well as agriculture safety. As the agencies worked together to create a process to establish regulations for agriculture biotechnology, they needed to bring in the best experts in the country to establish best practices. Just as has been done in the pharmaceutical industry, much of that expertise was found in the companies that develop the product, as well as the universities scientists that have related expertise. In regulating a pharmaceutical product, one would bring in a pharmaceutical scientist from the private sector and a health scientist from a university and regulatory members would hold discussions to determine how to move forward with a new drug. A similar process was used here in framing the regulatory processes that developed in the US Department of

Agriculture, and administered through the Animal and Plant Health Inspection Service. I was on one of those panels. As a professor and scientist at Washington University in St Louis when the discussions were held in the 1980s, I was involved in some of the early discussions about regulating biotechnology for plant virus resistance, a field in which I have some expertise. I was brought in as an outside expert, as were colleagues from universities around the country, as well as scientists from Monsanto, Syngenta, DuPont and others, who helped to lay out the nature of the science. This input, along with input from the agriculture and environmental science communities, and others in the community helped to frame the basis of what became the approval regulations for these new seeds that were being developed.

The critics of the process are in part correct; that is, the private sector was at the table. They didn't write the regulations, but they provided information that was then considered as the regulations were developed. In many cases, the private sector knows more about a technology than does the university scientist. That is probably less apparent today than it was 25 years ago, as universities have sought to catch up and are now leading in certain areas of science.

Mr Jack Bobo: I would just add that the co-ordinating framework was being established in the United States 10 years before the products were commercialised. So this was basic research in those companies at that time. They were not biotech companies; they were chemical companies. Also, the regulatory process followed in the United States is very similar to what's being done in EFSA, Japan, China and other countries around the world. The codex alimentarius has established plant guidelines for how to do a food safety assessment and that's the basis for how pretty much every country evaluates the safety of these products. There isn't as much difference as many people believe between how the US approaches it and how Europe approaches it. Perhaps the difference is that at the end of the scientific regulatory review process in Europe, there is also a political process, which is an additional layer that doesn't exist in the United States. I suspect that if we had to send the products to Congress for review, we would have a slightly slower approval process ourselves.

Q189 The Chairman: Going to the wider question, looking back at the data for the last 60 years of productivity improvements in United States agriculture, which has been really spectacular, and trying to look forwards, what do you think are the main factors that have driven those improvements—mechanical and biological—and can you give us some sense of the order of those? Looking forward, do you have any views on the prospective rates of growth in productivity in the coming years and what the drivers will be?

Dr Roger Beachy: I think the major key to success was the establishment of the land grant university systems, and research agencies which provided resources for research in the laboratories, greenhouses and field areas, and demonstration plots. By putting in place university scientists who took care of the local region around their university you put science at the crux of the means to a solution. When this is followed up by the involvement of the extension agent to get things to the farmer the result is a rapid increase in crop productivity. The adoption rates of the use of fertilisers after the Second World War speak to the positive effect of the approach. The use of hybrid seeds was a revolutionary approach to growing corn, aided by the work of the universities and extension specialists.

We need to recall that there was a great deal of reluctance in the farming community to initially accept hybrid maize and other hybrid crops. It was said that this was not God's will, this would not have happened in nature and is an unnatural way to improve agriculture. Gradually, the outreach by university scientists, along with seed company sciences, made

adoption possible. That investment was important for that first generation of the significant increases in yield that we have had in agriculture productivity.

The increase that we are seeing now is a consequence of the investment of more than 20 years in the fundamental science of genetics and its chemical determinant, DNA, in crop plants. What is the DNA sequence of the crop? What are the markers that identify a genetic locus that confers a useful trait? What causes a plant to be more drought-tolerant or to have deeper roots or to have higher yields? What determines whether you have one long ear of corn or three ears on a plant versus two? Such information is coming out of fundamental and applied sciences. The knowledge of genomes and how they interact with each other and with the environment helps to determine whether increasing crop yields will move rapidly or more slowly.

Much of the early work in crop genetics has been done on corn. We're looking back now and saying that the same investment should be made in wheat and barley as well as other crops. We're seeing advances in rice and corn because there were investments in these crops early on. The knowledge base that was created through these studies will help us into the next round of search for solutions to bring even higher yields, along with more sustainable agriculture.

What are the major challenges for food production? My colleague Jack has pointed them out. They are the changes in climate and the need for more food; increasingly we will consider not just the amount of calories, but the quality of calories. Where are the vitamins, the minerals and the antioxidants coming from? Will we factor the value of our cropping, not just in bushels or in tons per hectare, but in the quality of those calories, or the environmental impact of producing the calories, into our consideration of successful agriculture? Crop production per se is part of the solution going forward, yet, there will likely be a closer linkage between agriculture and food and nutrition and health. One will expect to see the biomedical community and the agriculture community coming closer together to develop a system that ensures sustaining agriculture while improving the health and wellbeing of those whom we serve in the community of consumers.

To achieve such an outcome will require far more knowledge within the biomedical community of the food and agriculture sciences, and vice versa, if we will eventually realise the importance of nutrition in, say, the prevention of certain diseases. Such knowledge will have be realised, because the biomedical and nutritional scientists collaborate with the food scientists who collaborate with the agronomists, who collaborate with the researchers who give them the genetics to get the right crops to the producers and the consumers.

The cross-disciplinary challenges to achieve this outcome are enormous. From the scientific perspective, it's a wonderful way to begin to use our past investment in genomic science to benefit humankind. As we bring in that past investment, invest wisely in new research for the future and then bring them to bear on those whom we impact—those taxpayers who pay the bills for the research that we do—the closer we can come to achieving a strong link between food and agriculture with health and wellbeing. Establishing the scientific validation of the linkage will require resources that we have not yet committed; it may require new partnerships between food scientists, nutritionists and biochemists, medical science, and healthcare providers as well as the private sector that sells the seeds and the foods. Perhaps more partnerships are going to be needed to fulfil the vision, but if we don't do it, we won't benefit those whom we wish to, and nor will we make sure that agriculture plays a key role in the discussions. All of this needs to fit together. We think there's no way to do that except through connecting the investment in research to those who will use the outcomes of that investment.

Mr Jack Bobo: I would add a slightly different answer to that. When you look at growth in production, a lot of it has to do with what part of the world we're talking about. Much of what Dr Beachy talked about is perhaps more focused on what is going on in the United States and Europe, but if you look at the OECD-FAO report that came out not so long ago, it shows that in the United States over the next 10 years, the increase in production is perhaps 15-20%, but in some place like Brazil they expect it to grow by more than 40% in just 10 years. Europe is expected to grow by about 4%. The reason that Brazil is able to grow at 40% isn't that they have that much more science and technology available, but they have the last 100 years of our R&D to apply, so they are able to catch up to where we are in productivity today.

The challenges from a technical point of view are great. If you go back 50 years, we were producing 40 bushels per acre in the United States. We are producing perhaps 180 today. But the potential yield of corn is more like 280-300 bushels. That's very similar to where it was 20 or 30 years ago. We really need science and technology to unlock the key to increasing the potential yield of our crops if countries like the United States and Europe are to be able to surpass what we have done in the past.

One additional side note is that it's not going to be just about production in the future; it's also going to be about value-added crops. We think of soybeans as soybeans today, but 10 years from now you are going to have dozens of types of soybeans that are all going to be adding value to that farmer. So it's not whether you grow soybeans or corn, but it's going to be high oleic or low oleic, or a lot of varieties that I can't even imagine today. There's going to be a diversity of opportunity that's going to meet the needs of different types of farmers.

Q190 The Chairman: Does the position in Europe, from where you sit, look rather strange?

Dr Roger Beachy: How blunt would you like us to be?

The Chairman: Very blunt, because this is very important for us.

Dr Roger Beachy: It is important and it is surprising because, as you are well aware, much of the fundamental science that leads to our success has also been conducted in Europe. It's disappointing that our scientific colleagues as well as the farmers in Europe are not reaping the benefits of the fundamental knowledge in agriculture and biotechnology that was developed, in part, in Europe. It does seem strange to us; there is a lot for us to learn from the European approach and to fully appreciate in the differences in attitude between the US and Europe. Nevertheless, the science is strong and the needs in agriculture are similar, namely to make agriculture more environmentally and economically sustainable and more protective of the environment. These are outcomes that we find are coming through applications new technologies. It is surprising to us to that some of the practices that have been so important for us, in natural resource management for example, are not being adopted for reasons that we hear about, but we don't fully understand.

To be quite frank, I'm also a little surprised and disappointed that agriculture, which was once so strong in Europe, hasn't taken a greater leap forward to being a critical part of the economy that it might be if the new technologies and new approaches are brought to bear.

I began today by talking about the success of the bioagriculture community in the US. We are very pleased with that. This sector is a strong piece of our economy and it's surprising that in Europe, with a wealth of good natural resources that could be brought to bear in this arena, the resources are not exploited or developed as much as it might be. A recognition of the importance of modern science can play is critical; the decision that you will make on

adoption of new seeds and other technologies will resolve this challenge one way or the other.

Lord Cameron of Dillington: I'm afraid I've got to go and take part in a debate in our Chamber, but I have given two more questions to our Chairman. Thank you very much.

Dr Roger Beachy: Thank you. It was nice to have you here.

Q191 The Chairman: Moving on, then, we'd like to try to understand what you see as the barriers to successful R&D, even given the great success of what's happened in the United States. Where have you sensed barriers and what learning could you share with us from that on things that we could hook on to?

Dr Roger Beachy: I think we've invested well in the fundamental sciences. That needs to be continued and in any of the discussions about resourcing science we need to consider the best ratio between investments in fundamental sciences—which provide the underpinnings of advanced technologies—or the translation of information from laboratories to new enterprises. Scientists discover lots of things and file many patent applications; yet the reality is that most scientists can not succeed in taking new their discoveries from the laboratory to the next stage of development for a variety of reasons. Some of this includes what is referred to as the 'valley of death'—that point between discovery and having utility and application of the discovery. We have a similar challenge in the US. Investing in that 'space' is not something that the investment venture industry does very well. NIFA has a small business innovation research activity—known as SBIR authority to provide—with grants that can help to start new entries, but that in itself is not sufficient.

Meanwhile we are aware of investments that are being made in other science-rich countries. India and China, for example, are investing in research as well as funding the 'valley of death' space to take technologies beyond the laboratory. That's a critical component to taking the successes from laboratories out into the field and to the public. If there was a hurdle to be identified outside the science, that's where I would look for solutions.

The fundamental science that underlies food agriculture is becoming more and more interesting and integrated. In some cases, knowledge acquisition is becoming less expensive to gather because of advances in technology, but the scope of the questions becomes more important than in the past. Let's take the example of greenhouse gases that are released by cattle. How is methane produced in cattle? Scientists have taught us that they result from a combination of the messages encoded within DNA of the cow and the DNA of the thousands of different kinds of microbes that live in the cow's stomach and the quality of the forage, determined by DNA in the forage and the growing environment, which the animal eats. If one is to address the issue of methane production from a cow, you've got an enormous biological system that is very complex. To try to solve that problem solely at the back end and not have the front-end knowledge seems a folly. You want to invest in both—the whole system of a short-term fix and maybe a long-term solution. That requires basic research and translational research, getting investments across the valley of death and finally developing a product that reduces greenhouse gases.

I think we have to maintain a balanced portfolio of funding. Maybe in our countries we don't do as good a job in that valley of death investment period.

Q192 The Chairman: How have you managed to shine a light into the valley of death? How have you managed to mitigate the effects of that?

Dr Roger Beachy: Again, I'll speak from experience, though I've never started a company. I've filed patent applications, but I never took the leap to become an entrepreneur; I have enjoyed an academic life. It is recognised that the larger investment firms have become more cautious of their investments since the bubble of electronics and IT that was experienced a few years ago. That reduced the willingness of the venture companies to take risks that are required to support true start-up companies. Most such investment is done by local angel investors and smaller venture firms. But even smaller venture funders are almost as cautious as the larger companies.

In more local settings, angel investors often syndicate to support new start-ups, sometimes matched by funding from the state or other regional funding sources. In some localities economic incentives support and other special conditions can assist a new company; I assume that such conditions occur in England as in the US.

To encourage, teach and mentor entrepreneurs some communities engage philanthropic foundations to support scientists who want to move to business activities; local experienced businessmen teach entrepreneurialism, management and business practices to those who want to start companies. University students are sometimes called upon to help in a start-up. Having these local councils become involved is an important part of the success of the locality, rather than relying on federal involvement; other than for limited R&D grants.

There are a lot of moving parts in regional economic development activities and some communities do it far better than others. Boston, Washington DC, San Francisco, San Diego, are well known for their entrepreneurial activities. However, few of these areas are invested in the food and agriculture sector. In this regard such activities in the agriculture region of the US including the Midwest region, are important; on the other hand, the Midwest areas are traditionally less entrepreneurial than on the coasts.

The Agriculture Research Service, a sister agency in the USDA, has developed a programme in which they work with their scientists as local entrepreneurial stimulators to commercialise some of the USDA technologies by bringing in new funding from outside.

It bears mention that the topic of translating knowledge to economic activity is very important for this administration. The Office of Science and Technology Policy—the OSTP—led by Dr John Holdren provides President Obama with input about this area, among others. OSTP sets policies that will develop science and technology, and to see that investments in fundamental science gets translated to useful products for Americans and others.

Mr Jack Bobo: In each country, one of the challenges is going to be the cost of getting through the regulatory system. Is the system transparent, predictable and science-based? The more expensive the system, the more burdensome it is and the more costly, that will discourage people from investing in that area and it means that products that might have a limited but very meaningful impact in horticultural crops or other things just won't happen. So, from the very beginning, just doing the math on the back of an envelope, you can determine that some crops are not going to be worth investment from the private sector. That also helps to distinguish where public sector research dollars might be more appropriate. Thinking about the regulatory system and how it influences decisions about investment and how that influences innovation are all extremely important.

Dr Roger Beachy: I would say, following from Jack's comments, that for many of us in the public sector the cost of regulations in agricultural biotechnology is the key to determining how or if we will bring new products to the producer and consumer. While many of the scientific discoveries that would benefit agriculture are made in the public sector, because of

the way regulations are handled, researchers generally do not carry a technology through the deregulation process because of the complexities of the system and costs associated.

Q193 Baroness Howarth of Breckland: Can I ask a slightly different question, which links to the general economic and fiscal policies that you were alluding to? People want to succeed in business, which means making a profit and all that goes with it. Some of our witnesses have talked about how the variables—the payment for their crops and the price of wheat—have been huge, and the planning that they have to go into to get from one year to another, and then the uncertainty about the planning for the following year. You may not want to answer this, but I just wondered whether there is anything that we should be doing, maybe in a broader, global sense, to ensure greater predictability about the commodities markets and the influence that they have. Although that's a very global picture, in the end it pans down to the individual farmer on the family farm trying to plan the crop rotation for the coming years, with the uncertainty that they have around them. I wondered if you had any advice about that scenario.

Dr Roger Beachy: I think I'll leave the answer to your question to the policy team. We have watched the debate and discussion quite a lot. There is a far greater global involvement in trade in agriculture than in the past as I understand it. When natural resources are available one wants to encourage agriculture development in countries that are underproducing and thus importing foods. It is predicted that many African nations could become very strong producers of agriculture products – perhaps being exporting nations. How do we accelerate that development while at the same time having policies that might be global today and change tomorrow or in coming years? I would enjoy listening to discussion that address these types of global challenges and opportunities. That process could be taken to a level that people like you and others can begin to address the global food security issues. It may well be that in the future, scientific advances may allow predictions of where a drought or a flood might occur that would destroy food production, and such an event might affect what happens in the US, of UK, or in Pakistan or in other parts of the world as a consequence of changes in supply patterns. These are some of the topics that should be front and centre of thought for those that are engaged in local, as well as global, food security issues.

Q194 The Chairman: We are coming to the end of our time, but because the science is so important, do you have any metrics that you could direct us to? How do you track the level of activity in research and extension? How do you know if it's going in the right direction or if people are cutting back on it?

Dr Roger Beachy: You've hit on a very important point for us, and we don't have an answer. There is a growing interest in the 'science of science measurement' and the 'science of science policy'. Posing the questions becomes very critical, as in any study. The national academies—your Royal Societies and the Academies of Science in the US and elsewhere, have a metric for success in engineering or medicine that might be different from the metric that you would want, say, in the agriculture sector. It becomes critically important to consider how one judges the success of an extension activity versus a fundamental research activity and how one rewards activities appropriately; does one reward science discovery more than applications of science to improve lives of people, or are they rewarded equally? Would one hire the extension agent whose recommendations preserve soil quality, or a famous researcher who brings recognition to —the university for her/his brilliance? We track progress in the universities, but they track their own employees and their outcomes. We are not good at judging how universities make best use of resources that they receive

from NIFA. The Agriculture Research Service likely does a somewhat better job of accountability than does NIFA.

Mr Jack Bobo: I would just add that if we look at big picture metrics, one that's meaningful is the fact that public sector research in the developed world has declined by about 30% over the last 20 years. The R&D levels are flat for most of that period, increasing slightly. The only reason they are increasing is that now the private sector accounts for about 30% of all agricultural R&D. So while it's great that the private sector has stepped up, that creates different pressures, because they are looking for different rewards and returns on their investment. One of the reasons why the private sector has been willing to step in—obviously it's not altruism in that they saw a need and are happy to fill it—is that in agricultural R&D there's a positive rate of return on ag investments everywhere in the world. That's why the private sector is willing to do it, but it also suggests that it's an opportunity, so if the public sector invests, there's also a return on that investment. It's something that we need to continue to keep in mind. There are those two factors. Looking at who is putting the money in is useful, but it raises the question of where that money is going.

Q195 The Chairman: I think that's where we were going. It's about the efficacy of government spending on research and, in a sense, proof to legislators that the money is going in the right direction. We are looking for the evidence to support that.

Mr Jack Bobo: I can get you a copy of the report that talks about the return on investment for agricultural research and development if that would be helpful.

Q196 The Chairman: Thank you, that would be tremendous. We are at the end of our time. We are very grateful. The valley of death is going to stay with us. We are going to be interested to see the role of entrepreneurs and risk-takers and private equity in that area. It would be very interesting, finally, to ask you whether you see entrepreneurs from other countries like China or India coming forward more quickly to exploit that dip that you described.

Dr Roger Beachy: I'm not sure if entrepreneurs are stepping up or if it's Government providing the funding bridge. I have the sense in both those countries that this is an investment by Government to help in the translation of fundamental science out into the community.

That's important for all of us to think about as we set our own policies on how we harvest from what we have invested in previous years. We might consider to be economic responsibility to harvest the data from prior investment and make it useful. It may require some bridging by funds that are essentially for public good.

Mr Jack Bobo: I would say that, perhaps not so much in China and India, but in Brazil you are going to see that rapid translation more and more to products.

Q197 The Chairman: Thank you again. The session has far exceeded our expectations. We are very grateful for that. Mr Bobo, we hope to see you next week when you are in Europe. Dr Beachy, if you are over here, we'd very much like to see you. Thanks very much indeed.

Dr Roger Beachy: Thanks very much. Bye bye.

Mr Paolo De Castro MEP

Oral evidence, 8 December 2010, Q 198-222

Evidence Session No. 6.

Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
The Earl of Dundee
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witness

Witness: **Mr Paolo De Castro** [MEP] and **Antonella Rossetti**.

Q179 The Chairman: Mr de Castro, you are very welcome and we are very grateful that you have come to see us today. I will just deal with the formalities and then we will ask you to describe the workings of your Committee before we get to formal questions. In front of you is a list of interests that have been declared by the Committee. This is a formal evidence-taking session of the Sub-Committee. A full transcript will be taken and will go on the public record in printed form and on the parliamentary website. We will send you a copy of the transcript and you will be able to revise it for minor errors. The session is on the record and is being webcast live and will be subsequently available on the parliamentary website. Could we ask you for the record to state your name and position, and then perhaps you could give us a few moments on the workings of your committee before we go to questions?

Paolo De Castro: My Lord Chairman, may I start by saying that it is an honour and a pleasure to be here in the Palace of Westminster to give evidence to the European Union Sub-Committee D on innovation in European agriculture.

Since my appointment as chairman of the European Parliament's agriculture committee, the Lisbon Treaty has conferred new powers on the European Parliament, giving it equal decision-making rights with the Agriculture Council. That has very much changed our life.

The reform of the Common Agricultural Policy post-2013 will be a particularly important aspect of our committee's work over the next couple of years. The committee is currently embarking on its consideration of the Commission Communication on the reform of the CAP towards 2020, building on the European Parliament resolution that we adopted in July—what we call the George Lyon report. As part of your scrutiny function, your Sub-

Committee will be aware that we also have a number of other important legislative packages coming up. We will have some of them tomorrow. Dacian Ciolos, the Agriculture Commissioner, will present the milk package.

To conclude my introduction, it is worth noting that there are two sides of innovation in European agriculture. As you know, I have just written a little booklet on the future challenges of agriculture. I would like to conclude my short speech with one clear sentence. Technological innovation in agriculture—mechanisation, genetic improvements and technical progress—in general is translated into lower prices for consumers, not higher profits for the farmers and the agriculture business. I like to start with this sentence, because everything that we talk about today on innovation or any other issues you would like to ask about is related to this. It is quite different from other economic sectors.

Q180 Lord Giddens: Good morning, let me add my welcome. We are very pleased that you have come here this morning. I congratulate you on your post and, if I might say so, on your exemplary career to date, speaking as one academic—or partial academic—to another.

I shall start by asking about an issue relating to how one moves from innovation to farming practice. In a recent inquiry of ours on adapting EU agriculture to climate change, one of the main findings was the importance of taking the outcomes of innovative research and making them practically available to farmers. That issue has come up in many aspects of this inquiry. I have three questions. How do you think this process is most successfully achieved? How well do you think the CAP's requirement to set up farm advisory systems is being implemented throughout the EU? And what more might the EU do to improve farm advice? Comments on any or all of these issues would be welcome.

Paolo De Castro: As you will have been told by previous witnesses, innovation and technological progress are important factors underlying economic growth. Improving productivity relies on the adoption of innovation associated with new technology products and improved working practices. Bridging the gap between academic research findings and practical application is the critical factor here, and you were correct in your previous inquiry in outlining the importance of providing farmers with useable advice. While private and public investment is needed in research to develop new and innovative techniques, of equal importance is making sure that knowledge about current technology and the best working practice is disseminated as widely as possible.

The Common Agricultural Policy already provides support to foster knowledge transfer through what we call the second pillar. There is a wide range of rural development measures aimed at improving knowledge transfer, training and innovation. I believe the written evidence you have already received from the European Commission has highlighted some of these. Even our European Parliament resolution of 8 July on the future of the CAP after 2013—what I call the George Lyon report as I said before—noted that the climate impact of agriculture can be considerably mitigated by means of improved education and training of people working in agriculture, better use of innovations stemming from research and development in improving the efficiency of agriculture production.

Of course, advisory and extension services are very important for the dissemination of knowledge. The CAP already requires member states to set up farm advisory systems. Often, farmers are more likely to take up advice if it is provided from local, trusted sources. This means that the establishment of networks to allow farmers to share experience can be enormously important, as you can use farm demonstrations.

We need to underline clearly how the farm advice system should work, because not every country works at the same level, as the Commission report says. For example, in England there is not a single system to make contact with a group of farmers. The problem that I have to stress is that the farm advisory system doesn't work very well in the sense that the farmer looks at the system just to understand how the rules and the cross-compliance should be applied. The rules are not really welcome sometimes. We need to reflect on how the farm advisory system can work better. Disseminating innovation to farmers is one of the most important things that we should reflect on.

Q181 Lord Giddens: Could you give us some indication of what improvements should be made and how?

Paolo De Castro: First of all, we need to reflect on the balance between the European level and the national level. We need to ensure that there are good relationships with the farmers. They need the information on how to implement such technology, not only because they have to follow the cross-compliance rules, but because it's important to understand the implications of the innovation, of the new technologies and of the new scientific evidence on farming. It's important to know that this is one of the key issues for the future, because without implementing such new technology we probably won't be strong enough. Competitiveness and sustainability are the two key issues for the future of the agriculture sector.

Q182 Lord Giddens: Have you got any concrete examples of best practice that you could offer us?

Paolo De Castro: When we talk about best practice, we are talking about cross-compliance. When we apply the new Common Agricultural Policy, we follow a direction of not giving money to farmers just because they are farmers, but because they put into practice good suggestions. This is the core of the cross-compliance issue. It does not always work in a wonderful way, but that is the key change of the 2003 reform, when we changed from the older CAP to the new CAP. We will try to reinforce this with the new reform, to make it clear that farmers should adopt best practice, because their work is important for all citizens in Europe. Good practice should be enforced and explained. Maybe we should adapt the farm advisory system to work better.

Q183 Lord Giddens: Does that mean being more aware of local cultural sensitivities?

Paolo De Castro: Exactly. This is one of the key questions, because farmers trust the local much more than the general approach. How can we force the local system to follow the farmer's job every day to manage the problem? Otherwise it will be difficult for farmers, because they are pushed a lot by the people who sell the chemicals or other technology. We need an extension service that works from the general point of view because they have to give the public an unconfused answer to sell the product. The United States extension service can be a great example of that. It works at the university level. But of course I have to say that the current system has some problems and we need to improve. New technology and innovation should be enforced more widely than in the past.

Q184 Lord Lewis of Newnham: Thank you very much indeed. That has been extremely helpful. Perhaps you may find this question embarrassing and not wish to answer it, but in the whole of Europe, where would you point us to a country that has been very successful in doing this job of getting the farmers involved and educated in new technologies?

Paolo De Castro: I am sorry, but I don't know if I am able to answer this question. If I have to focus on the various member states and give a picture of where it works better, it depends on the farm advisory systems in different member states. If I look for a country where the link between the private and public systems works, you can have a good answer. I don't know if I can say, in my country, for example, we have a lot of problems between the national and regional systems, which sometimes overlap. We really don't understand it clearly at the level of farmers. That means that the farmer sees that system as a way of finding out what they have to do to get money from the European Community, not to realise how important it is to implement new technology to reach specific goals. I am talking about natural resources systems and new irrigation practices, where we need to follow new technology to do it right. In this case, we need to do more. If the new CAP after 2013 goes in this direction to implement the new technology and innovation more, we need to change something.

Q185 Baroness Sharp of Guildford: My question picks up on the same points. Insofar as you see the CAP wanting to promote this, where does responsibility for promoting these services lie? Do you see it lying with member states, with regional governments or, insofar as you want to see it bottom-up, at a very local level?

Paolo De Castro: We have the first pillar and the second pillar in the Common Agricultural Policy. In the second pillar there are many instruments that can go in the right direction. It depends how well the national Governments implement the second pillar. We have some national approaches and some regional approaches. For example, the national approach to rural development in France has very clear evidence of what is needed and everybody at local level follows one scheme. When we have a regional approach, it depends very much on how the local administration works. Sometimes, rural development can work well because they are well connected and there are good relationships with the farm unions and the co-operatives there. And sometimes it doesn't work. This means that we are not using the second pillar instrument in the best possible way.

As we move into the future, we are moving to transform the first pillar closer to the second, in the sense that we want to follow environmental issues and follow much more closely the new public goods idea of what agricultural people should do. In this sense, we need to have a clearer national idea for implementation of that and leave subsidiarity to the local, regional government which they have to apply as best they can, without taking specific decisions against some others. There can be some overlap.

Q186 Baroness Sharp of Guildford: So it is essentially up to each member state to set up the organisation that they feel best fits for them?

Paolo De Castro: I think so.

Q187 Lord Lewis of Newnham: Could we turn to the funding of research, which is the other side of this coin? The seventh Framework Programme devotes about 4%—€2 billion—to food and agriculture and to biotechnology. How far do you think that the EU research programme has supported agricultural innovation? What changes would you like to see after the 2013 cut-off date for the seventh Framework Programme? Can you see how the national research budgets could be more effectively mobilised into this system?

Paolo De Castro: This is one of the key problems in many discussions in committees on agriculture and rural development in the European Parliament. How can we improve the framework programme for agriculture and research? It is a very small budget—less than 4%.

If we look at the innovation needs of the agricultural technology sector, we really have to rethink the new framework programme. We need to invest more in research. This is not particularly linked to the Common Agricultural Policy, in the sense that there are not specific budgets on research. Maybe we can encourage the application of research and force farmers to go in that direction, but the research budget is another directorate. We already say many times in the George Lyon report that we need to reinforce that. The key issue today is the food security issue and how we can answer this big question of ensuring there is enough food in the world to feed people. The increase in demand for food is much greater than the increase in supply.

We need to realise that to answer this very big question, we need research and innovation and it is impossible to use just the 4% of the total framework. We need to do more on that. The reforming of the financial perspective from 2013 to 2020 is the correct place to look at the budget. Agriculture can play a major role. It is not just separate. I think we have to encourage and establish better transnational networks, ensuring knowledge is available between member states. There are many things to do on research, especially on biotech, which is a very delicate issue. I don't know if we will talk later about this important issue.

Q188 The Earl of Dundee: Do you think that subsidies may undermine the readiness of farm businesses to adopt innovation?

Paolo De Castro: In my mind there is no direct link between farmers receiving subsidies and not wanting to invest in innovation. The problem with investment is having a picture of the future farm that can be strong enough to stay on the market and overcome the competitiveness problems. There are no direct links to the issue of subsidy, first of all because the 27 member states have an average of 20-25% of the income, so of course they need to be emphasised much more because otherwise they don't have enough income. It's important, because the new problems today are linked to market instability, which is linked to price volatility. We need subsidy to give farmers a good climate to invest. I don't think the subsidy makes people weak at adopting innovation. It needs to be a safety net to make farmers strong enough to continue their business, to continue to invest and to continue to trust. Of course, we need more transparency. That is a general topic for the new CAP. Several members of the agriculture committee talk about how that can happen. In the future CAP there will be some news on that, in the sense that we want to make the reform much closer to the citizens rather than closer to the farmers.

Q189 The Earl of Dundee: As you say, looking to the future it would be good to be prescriptive and not to make a distinction between farm businesses that are more reliant on subsidies and others that are not. Nevertheless, looking at the evidence to date do you think that a pattern has emerged a bit and that it might show, so far, that businesses that have been more reliant on subsidies are not quite so innovative as farm businesses that are more subjected to the commercial market?

Paolo De Castro: When the Common Agricultural Policy was just about encouraging the farmer to produce without taking into account all the factors that we have to consider today, like the environment, or even innovation in this sense, that was probably true. But today, with the new issues that we have on the table and the new problems of competitiveness, sustainability of natural resources and food security, we need to focus the subsidy much more, particularly the first pillar, on the public concerns about the behaviour of the farmers and what they do for all the citizens. We need to show clearly in the future how this policy can clarify to everybody that it is a policy for all citizens.

Of course, some things don't work. Sometimes the trade-off is that it will not be too complicated. Simplification is given with one hand and on the other the farmer is forced to do something in particular. We have to be aware of that. Yes, we want to force farmers to go in the right direction with good practice, taking care of the environment and all the problems that we have on the table, but at the same time we need to make them more competitive, to be strong enough to win. For that, we do not want too much complexity in the application of European rules, which is one of the stronger criticisms that we have heard.

Q190 Baroness Howarth of Breckland: I wanted to follow that through a little. If, in order to get the outcomes that you want, including environmental outcomes, you need better innovation to increase productivity—the first thing farmers need to do is produce more food, because there is a world food crisis—would it not be better to direct any subsidies specifically towards seeing through that change between the research and knowledge and the innovation to farmers, so that you can see that change happening? I don't know a lot about America, but we talked to them last week—China is also relevant here—and they seemed much clearer about the way they use public money to drive the innovation, which then increases competition and movement forward. I wondered whether the Commission had thought through that kind of package.

Paolo De Castro: The goal that we have today is how we can simultaneously encourage competitiveness for farmers and achieve sustainability. Of course, that it is easy to say, but it is another thing to do it. Competitiveness today is key. Our farmers are in the global market. They are in the same market as people around the world who do not observe the European standards on safety or animal welfare. Of course, with this competition we need to force our farmers to be stronger, to be well organised and to get away from the old approach when the farm policy was to maintain the price and produce more and not worry about anything else. Today we need to take another important step on environmental issues. The key is: produce more, consume less and pollute less. That means we need technology and innovation. Not everybody is clear about how we can produce more and consume less. We have a problem with water, not only in Europe, but across the world. Agriculture consumes 70% of the planet's water and we don't have enough water for everybody. The increase in demand, especially in China and India, is not only because of demography, but because of the impact of increasing incomes. That has a tremendous impact on demand. If we look just at figures for meat, milk and animal products, the increase in these countries means a tremendous increase in demand for cereals such as maize and soya beans to produce the animals. The relationship is more or less that 1 kilo of meat means 7 kilos of cereals. We need to realise that all our policies, including the Common Agricultural Policy, but also other important policies in the world, such as in the United States and China, should be aimed at the future problem for everybody, which is how we can get such an amount of food. We don't have it.

We realise how important climate change is and we are making some improvements. Copenhagen was a very important appointment for Europe. Everybody realised that climate change needs to be taken into consideration day by day. We don't have the same awareness of food security, but it comes before climate change. Food security is an issue for the next five or 10 years. We are looking at price volatility today. For example, the price of sugar, at more than \$1,000 dollars per tonne today, is the highest price in history. The food industry in Europe is not able to find enough capacity to produce.

Everything is changing, even the relationship between the food industry and farmers. Before, the food industry said that they needed to be free to buy whatever agricultural products are cheapest in the world market. Today, they come to our committee in Brussels and ask us to

maintain the agricultural capacity here because they can't find the products at the price that they need. Price volatility is increasing and all the evidence shows that it will increase in the future. So if we start from this point of view on how we can manage competitiveness and sustainability, we can realise how much more effort and innovation should go into the future Common Agricultural Policy. This comes back to the problem of biotech, which is probably one of the answers.

The Chairman: I think we are coming to that in a moment, if we may.

Q191 Baroness Sharp of Guildford: We have been talking about cross-compliance and the first pillar, but in the recent communication on the reform of the CAP, a lot of emphasis was put on the second pillar in terms of promoting competitiveness and innovation on the one hand and meeting the challenge of climate change and the environment on the other.

In practical terms, how do you and your committee see the future of the CAP most effectively supporting innovation in the agriculture sector?

Paolo De Castro: How the new Common Agricultural Policy can enforce the correct direction is the key. The communication from Dacian Ciolos arrived on 18 November, so we have a very general picture. It was just a few pages. When we made the George Lyon report, we had more than 800 amendments and 50 compromise amendments. The Commissioner is now speaking very generally in a few pages to say that we have to go in this direction. It looks as though they are leaning towards the Parliament's concerns. We are waiting for the next European Parliament report on the communication. Albert Dess will be the rapporteur on that.

This is the key. My personal view is that we should look not only at the second pillar. It is important, of course, that we have a broad approach on that. Everybody wants the second pillar and we have debates about it, but we need to force the first pillar to go in the correct direction. The communication from Dacian Ciolos says that we need to move the agri-environmental measures in the second pillar into the first. We don't want to mix, but we need to realise that even the first pillar has to go in the correct direction. It is not just a subsidy because you are a farmer. You have this amount of money, but you need to produce these public goods for everybody. Yes, you should be competitive, but at the same time we need you to take care of natural resources, animal welfare and all the environmental problems. We cannot make any environmental policy without taking the farmers into account. They manage more than 50% of the total land, so we need to give a clear picture. So the second pillar is okay. We can improve it with some European-level rules, but at the same time we need to force the first pillar to go in the correct direction.

Q192 Baroness Howarth of Breckland: There is clearly a tension between some of the innovation in agriculture and some environmental and consumer policies. The real trick is how these are brought into balance and managed together. We have heard a great deal of criticism of the EU's GMO policy and the recent pesticide regulations. They have been seen as obstacles to innovation, imposed by the European Union on the farming community. We have also had a recent regulation proposed by the Commission on a temporary ban on the cloning of animals for food production. We realise that there are a number of issues around all of those, but could you say a little about these competing objectives involving the Commission Directorates General? We need a clear strategy to support innovation in agriculture. If you look at the amount of development in agriculture in the States, where they seem to be surviving despite eating GMOs, compared with production levels in this country, we need to examine this.

Paolo De Castro: This is one of the key issues. Biotechnology and GMOs are part of the answer to the problem. I am not talking for the agriculture committee; this is my personal opinion. I think there would be a majority in the agriculture committee for my approach, but we haven't voted yet so I cannot say. I think we are going too much in the direction of the fundamentalist approach rather than a scientific approach. We need to give clear evidence from a scientific approach to explain what we are talking about when we refer to biotech or genetically modified organisms. People are scared. They don't know. We have a lack of information to our consumer. This issue falls to John Dalli, the Commissioner for Consumers and Health, not to Dacian Ciolos. We are asking him to make more information available. If people continue to say that GMOs are Frankenstein food and make European citizens scared, we will not go in the right direction. Yes, some member states are more scared than others, but generally speaking the problem is that people at European level don't know about GMOs. They don't know what is being done, not just in the United States. There was criticism because some environmental associations attacked the United States because multinationals were studying how to sell more chemicals, like Monsanto's soya beans. This has completely changed in the last 10 years, when all the world has invested a lot of public money in biotechnology. Now, particularly in Asia, in China and India, there is a tremendous impact and results from the new GMOs. The GMO approach is important to save land, to save chemicals, to produce without using a lot of pesticides, to produce while using less water and to produce on dry land. How can we answer these important problems without using biotech?

A few days ago, the Vatican's Scientific Academy came out with an important paper. It was very heavy, because it was the conclusions of 45 different scientific academies around the world on GMO and biotechnology. The final sentence was very clear and shows that the approach can be changed. It said that we need to go in this direction. It is a question of ethics in favour of that. Sometimes Europe looks a little scared when we have to manage innovation and biotech. I am not particularly in favour, but we need a clearer scientific explanation of the problem, not just because there are some very strong environmental activists who are pushing to paint it in a bad light. We need to study and to provide better information on that.

Q193 Baroness Howarth of Breckland: How do you do that? How do you get the public in Europe to understand that yellow rice in Asia and sweet potatoes in Africa are going to transform some of the vitamin deficiencies? In Europe, we're at a standstill. I spent a lot of time in the Food Standards Agency when this started and I know the groups that are against the science. How do you get through those groups? What lead can Europe give to help us forward?

Paolo De Castro: Again, in my personal view there is a lack of information, so the first thing I suggest is that the Parliament should push Commissioner Dalli to give more information. This can come in many different ways. We don't just need to give an abstract scientific outlook, but a clear picture of how this technology can change our lives for the better and what it is doing in many countries around the world. People don't know that.

The John Dalli proposals on GMO will very soon be voted on in our committee. Some people are against the Dalli report. It is a kind of renationalisation. They say that just because at European level we don't have a majority in favour or against, we leave the decision to member states. If they want to cultivate, they can, but if they don't want to cultivate they don't have to. They don't have to give scientific reasons. Member states can just decide. That doesn't work. We give Europe a lot of power to decide many important things in our lives. If we just renationalise the decision when there are important things, it cannot work. We need

to press ahead and to give a scientific approach. This paper that I mentioned before can give us a better picture of what we have to manage: produce more, pollute less and consume fewer resources. Without biotechnology there is no way. I don't want to say that it is the only answer, of course, but it is one of the important answers to this big problem.

Q194 Lord Cameron of Dillington: Good morning, Dr De Castro. I am very glad to hear your personal support for technology advances, including GMO. I hope you manage to persuade your committee and your fellow parliamentarians. We have been talking to the United States over the last week or so. They referred us to the OECD-FAO report, which said that over the next two or three decades agricultural productivity in the United States was going to go up by 14%, in Brazil it would be 40% and in the EU it would be only 4%, because of our technophobia. One of the things they commented on was that if the United States had the system that we have in Europe—modern technology is examined scientifically and goes to the scientific committees, but at the end it is then voted on on a political basis—everyone would vote along party lines and all sorts of politics would come into it, so probably a lot of the advances in the United States wouldn't get through because of politics. I think I agree with you that the compromise whereby it goes back to member states is a false premise. Is there any way we can take the politics out of it?

Paolo De Castro: I am trying to work together with the United States Congress, because the Lisbon Treaty gives us this new power, compared with the previous legislature in which the Parliament just gave an opinion. Today we share the same power as the Council. This is a good opportunity to work together with the United States Agriculture Committee in Congress. I have just been to Washington to meet Collin Peterson, the previous president—the election changed the president and now it is Mr Lucas. I am going to organise a meeting in June to link the committees from the European Parliament and the United States Congress. One of the issues is how we manage the problem of food security and innovation in technology. We can work together much more today than we did in the past, thanks to the Lisbon Treaty, which gave us a role to play.

Usually the United States goes to individual member states to solve specific issues. I understand that, but today there is a better approach. We can really work together to make all the effort to explain to the politicians, who need to vote and to give their support. It will be difficult. Many times while I was an Italian Minister of Agriculture I was very aware of this. People were waiting in my country and others. When we talked in the Agriculture Council, we had the same problems of how we could manage the reaction of the people. The only answer is that there should be more general information on that.

It is not possible that we give equal weight to Nobel Prize thinking and to environmental associations. They are very good and I don't want to say anything against them, but of course there is a difference between them to take into consideration. My friend José Bové, who is the vice-chair in my agriculture committee, is very much against this and is on the side of the paysans. I said to him, "Listen, I would like to understand you, but what if somebody asked me to choose between the José Bové approach or the Nobel Prize Rita Levi Montalcini approach?" I come from a university, so I am used to such approaches. We need to think carefully what we are talking about. Sometimes Europe really doesn't know why it is going in this direction. It is important to look very seriously whether there is any evidence for damage to human health and the environment. The precautionary principle is very important, but we need to share the clear picture that the world is giving to us—more than 124 billion hectares, and increasing year by year, and Europe is against all this. It is fully aware of the research and all the innovation. We need to react, because otherwise we don't have enough.

Q195 The Earl of Arran: What you say is very interesting. Moving on to the critically important livestock sector, about which we have heard very little so far in our evidence, you say that it replied very positively to the questions you put. How does livestock compare at the moment on innovation in the agriculture sector?

Paolo De Castro: Innovation in this sector is particularly interesting. Livestock as a sector is under the lens and is much more controlled because of the environmental impacts. We need to make clear the progress we have made. Looking at the emissions from the livestock sector at a European level over the last 20 years, the situation is getting much better. When we act on extensive production, when we force the farmers to use best practice, we realise that the evidence is clear that we are making improvements. The problem is that the demand for animal products is increasing so much. When I see the picture for meat consumption in Europe and in China and how it is changing, it is incredible. Some day soon we will need to answer the question and reflect on the impact of our diet. We cannot just replicate the European diet in other countries in the world. If we go in this direction, there is not enough land and not enough animal products. We need to think much more about that. Not everything is the same.

When you talk about the livestock sector, there are many differences. Poultry is different from pigs or cows. Beef is the biggest consumer of water. That doesn't mean that we can say that we can't consume it, of course. We need to take into consideration what the world is doing, but at the same time, we need to force the producers to implement best practice and to reduce the environmental impact and the greenhouse impact. If I take the figures for the last 20 years, I think the Common Agricultural Policy is doing better. We can do more, but I want to stress that we are going in the right direction. We always say that everything is getting worse, but if we compare the situation over the last 20 years, Europe is doing better. With the future Common Agricultural Policy, we have to force this direction more, because the environmental impact will be important, but at the same time we need to say that the reformed Common Agricultural Policy in last 10 years has been doing better than in the past.

The problem is not easy to solve. I don't have an answer for the future, but we need to continue to work in the correct way, as we have done in recent years.

Q196 The Earl of Arran: What about innovation in breeding, mentioning GM and so on?

Paolo De Castro: We import 90% of our soya beans from countries that produce GM, such as the United States, Brazil and Argentina. This is another strange aspect of European society. We make very high quality products, such as Parmigiano Reggiano cheese in my country, which everybody thinks is fantastic and is proud of, but without GM soya beans we could not produce it. But we cannot cultivate them. We really need to approach these problems in the correct way. We can launch a specific project to increase the European production of proteins. That could be useful. We are working on that. There is a report from Martin Hausling in our committee on improving European production of proteins. But we have no chance of matching the million tonnes of soya bean that we import. Europe should open its eyes more and give a specific picture to our citizens. Otherwise, in a little while we will get other problems.

Q197 Baroness Parminter: You have said that the marketplace we are in is about getting more food from fewer resources. That is an analysis that we have had from a lot of other people who have come to talk to us. In the livestock area, that has animal welfare implications in terms of increasing industrialisation. Lord Cameron referred to the strength

of the American market on food production growth, where we are now seeing animal cloning and increasing superdairies housing levels that we don't see anywhere in Europe. The EU has had a good record on ensuring a balance between animal welfare standards and growth in food production. In Europe, is animal welfare now seen as a barrier to innovation in agriculture or will Europe maintain that balance between ensuring good standards of animal welfare while seeking food growth?

Paolo De Castro: My personal opinion is that we need to continue to follow the animal welfare issues. We should be proud of our high standards of animal welfare. Of course I realise that this is another important issue that is debated in our committee almost every week. They say that the problem is not with the high standards of animal welfare, but with importing from other countries that don't follow the same standards. We need to force people who export to Europe to adopt the same standards that we use. It is easy to say, but not easy to make it happen. Third world countries don't have the same system that we have and it is much more complicated for them to introduce animal welfare standards. To give you an example, on 1 January 2012 we implement a new regulation on egg production under animal welfare rules. We have changed the system of cages. Everybody said yes. At that time I was Agriculture Minister and I was proud to put my signature to it in 1999. But now everybody is saying, okay Europe has reached such a standard, but if on 2 January 2012 we import eggs from countries that don't follow the same animal welfare rules, this is a distortion and it will make our farmers very upset.

So sometimes the problem is how we can make this balance. It is not easy to put into practice. We want to be first class when we talk about animal welfare. If I talk with my friend in the United States Congress about the movement of cows between North Dakota and the Texas livestock people, there is miles and miles between. It would be impossible with European rules. They would have to wait every eight hours and give the cow a little break before carrying on. There are many differences. I am proud that we are going in the right direction, but we need to consider how we can implement the rules in the right way, otherwise European farmers have a right to push very hard on that.

Talking about cloning, the lesson of GMO was very clear. I think John Dalli is doing a very good job. He said that we could decide whether we are in favour of cloning or against, but we have to say very clearly that this has nothing to do with human health and safety. If Parliament wants to say that we don't want cloned animals, we should be clear that this is an issue of ethics and has nothing to do with health, the environment or animal welfare.

This is important, because sometimes people can be misled on that. When we talk about GMO, even if there is 20 years of evidence and not one problem in the countries where it is in use, there is still a lot of debate about whether it is dangerous and causes health problems. It has a bad image, but there is no scientific evidence for it. There were some problems in some scientific papers, but right now, with years and years of using GMO in the US and other countries, there has been no scientific evidence of a single case of problems specifically related to this. We are trying to start the debate on cloning in this direction.

At the same time, I have to say that on cloning the situation is difficult compared with GMO, because of the ethics. For example, there are religious concerns. Some Christians are very much against it. They say that it will come to human cloning. I don't think it will be an easy time. We have already voted in the plenary, but I think John Dalli has to do the best to give the right picture even on this difficult issue. I am very curious to understand what is going on in the future, but if we have to go fast, cloning is the system that will be implemented fastest in breeding improvements. If I have to give my personal view on the long-term picture, we will need to talk again.

The Chairman: I am conscious that we have a couple more questions. If we can keep Mr De Castro, I hope that we are content to go on for a few more minutes.

Q198 Lord Giddens: I was just going to ask whether you could comment briefly on what could be done to control methane emissions from livestock.

Paolo De Castro: Yes, everybody realises that livestock has that impact on the environment.

Lord Giddens: Globally, it has a substantial impact.

Paolo De Castro: Yes, if we look at the figures, it is more than 10% of the total. I don't have the answer. We are talking about it. The emission figures for Europe have been changing in recent years, because of the Common Agricultural Policy reform. We are looking at a reduction on that. We are going in the right direction, but we need to do more. We need to implement good practice more widely, but the problem is still there. We need to increase production to meet demand. We need to consider what kind of technology can help us. There are some studies on it with good evidence. We had a workshop in our committee to show the habitats and diets of cows that could reduce the impacts. We need to work a lot on this. The direction is correct, but we need to do more.

Q199 Lord Cameron of Dillington: I believe that today the Commission is producing a package of documents on product quality policy, covering geographical indications and certification schemes and marketing standards. Keeping in mind our agenda of innovation, what do you hope to see from this new policy and do you think it can be used to encourage farmers to be more innovative?

Paolo De Castro: Quality is one of the main issues to make European food production more competitive. We lean more towards our heritage and territory. It is different in different member states, but we can translate the history of our food in cooking and typical regional foods. Europe established the quality system of geographic denomination, but it is not very widespread. We have about 1,000 geographic denominations in Europe right now, but 80% of those are in just three countries—Spain, France and Italy. There is also a little bit in Greece. Now, it is increasing a little in all the countries of Europe. I think that is good news. We need to use our quality and diversity. Sometimes, the geographic indication product doesn't just taste better than others, but it is a link to some traditions and specific territories. Because the consumer today is interested in knowing more about food, this is an interesting marketing tool that we can use. This applies mainly to Europe and not to other countries in the world. Maybe there is Napa Valley wine in the United States or Chinese spaghetti—they have just asked to give it a European geographic denomination. It is a real European task. We need to reinforce that, because in global competition, as we know, Europe is a force between the two big powers, with Latin America on the one hand and China and India on the other. They squeeze Europe a little, because there are not the same costs of production. They have big land and lower costs of production. They have many things that a small and densely populated Europe cannot compete with, so we need to compete on quality and diversity. I don't want to say that other countries don't have quality products, but sometimes our diversity can be useful to make us more competitive.

Dacian Cioloș will show us the milk package next week—tomorrow will be a holiday, so we will be a little late in the presentation. The core is that we want to maintain the three-level system of geographic indication, denomination and traditional ones. There are some rules for better implementation of these and there are some specific rules on labelling of country of origin. That is a big issue and not everybody thinks the same, so it will be interesting how

we can approach the second part of the quality package, on country of origin labelling. Dacian Ciolos says that we need to show the consumer all the information and we should know where every product comes from. Sometimes this causes fighting between farmers and the food industry. Not everybody thinks the same, so it will be interesting. Whether the consumer will be interested will depend. Anyway, this is the quality package. There will be more attention to the European rules and how we can implement them better. At the same time, there is some news on labelling.

Q200 Lord Cameron of Dillington: I would come from the principle that you should be allowed to put what you want on the label to make your product sell, as long as it's true. That is the only regulation that we need. We did a report on the wine industry. Frankly, the regulation from Brussels was very uncompetitive.

Paolo De Castro: I know that wine is a particular sector, but sometimes there is a misunderstanding when people think that products come from the same country because they have the same name, like Parmesan or whatever. People can misunderstand and companies can take advantage of the knowledge and history of this product, even though their product has nothing to do with it. There are WTO rules, because we are not good enough to implement such important rules at European level. Many countries in the world are against it, because they see such a system as being against competition. That depends on sensitivities. Some countries, such as my country, are pushing. I think it could be one of the bases to make a stronger European presence in the market, without telling a lie. We should be correct in our approach, of course.

Q201 The Earl of Caithness: As part of Europe 2020, the Commission has proposed an Innovation Union. One of the partnerships is going to be agriculture. How would you make that partnership an effective instrument rather than a European talking shop?

Paolo De Castro: Thanks a lot, my Lord. When President Barroso presented the Europe 2020 strategy, we were very upset in the Parliament because he didn't mention the role of agriculture and how important it is. We applied pressure in the Parliament and the Council. Finally, in the last presentation of the Europe 2020 strategy, the Innovation Union for agriculture took the floor.

Sometimes we talk about agriculture as something very old and traditional. It is not competitive and we can forget it. We really don't understand how strategic agriculture will be in the future, because of the issues we have talked about before, such as food security. Not everybody realises that. Even sometimes at European level when we talk about agriculture, it is just a basket to get money to finance other policies. There is a lot of money for agriculture. We don't realise that the situation has changed very much.

We have left the era of surplus and come to the era of scarcity. We need to refocus what an Innovation Union is. In my mind, agriculture is at the centre of an Innovation Union and the new global challenge. That is the title of my short booklet, which I have mentioned many times today—I'm sorry. In my mind, this is the key. Agriculture today is not just one sector or another. We are making the Common Agricultural Policy not just because we want to help farmers. Yes, of course we want to do that, but agriculture has to play a very important role because of the global challenge of climate change. Agriculture is part of the problem, but it is also part of the solution. On environmental issues and the use of natural resources, agriculture can do a lot on using water better, not wasting water. The new technology seeds use less water.

Agriculture is a strategic point in the Innovation Union. We need to refocus on that and to explain to the Prime Ministers around Europe that agriculture should not just be old and traditional, allowing people to say we don't care about that, it is no problem, because we can buy food anywhere in the world. In the future we need to produce more food in Europe. The problem of quantity is as important as the problem of quality. We need to think about the next generation and its problems.

A few years ago the problem was exactly the opposite. We remember the butter mountain and the cereals mountains. The Common Agricultural Policy produced a lot of problems. Then we changed the policy. Now is another era. We need to understand that and think about agriculture as an important part of innovation in Europe.

Q202 Lord Lewis of Newnham: Does that mean that you would want to vary significantly the differences between pillar one and pillar two?

Paolo De Castro: The problem arises because I don't want to say that the second pillar is the good one and the first pillar is the bad one; the second pillar is legitimate and the first pillar is not because it is just subsidy. We need to have a clear picture that the second pillar is part of the same policy and it has to give the right answers to the problems that are on the table.

We want to maintain more links between the two because everybody realised that farmers, who produce public goods, need the first pillar. Then it looks similar to the second pillar, which has such legitimacy. It is more a question of the architecture of the CAP. In the first debate in the European Parliament on this, we tried to create one pillar, not because we don't want a second pillar, but just to show that there is one policy. Then you can have different actions to follow what we need. There are some rumours that the second pillar might be moved from the CAP to another European policy. We think that it would be wrong to move it to regional policy. We should explain clearly that we need both to give a correct answer to the problem.

Q203 The Earl of Arran: Do you ever consider a northern Europe and a southern Europe for agriculture, such is the difference between the two?

Paolo De Castro: North and south? This is the traditional problem. If I look at the budget figures for the Common Agricultural Policy, we give a lot of support to the north, in the sense of the more continental products compared to Mediterranean products. In this case the new Common Agricultural Policy after 2013 can give the correct answer. We can completely eliminate historical reference. We have to redistribute this amount of money with new criteria that take into account the environmental issues and employment issues.

Some good answers to the difference between north and south in Europe can come from the new CAP. I hope that that will be good enough to show that this policy is not aimed at helping some people more than others. Some people say that there are a lot of rules that help French farmers more than other farmers. I think this policy can help a lot to show that the rules are the same for everybody. Then the market is there and everybody can play their role.

The Chairman: Well, Mr De Castro, thank you very much. We have had authoritative and comprehensive answers. Your commitment to all of this is clear. We are delighted with the evidence you have given us. Thank you very much.

Paolo De Castro: Thank you very much. It is a real pleasure.

ADAS

Oral evidence, 15 December 2010, Q 223-275

Evidence Session No.7. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witness

Witness: **James Clarke**, [Science and Business Development Manager, ADAS].

Q204 The Chairman: Well, Mr Clarke, good morning. Thank you very much for coming to see us today. I just need to deal with some formalities to get this started before going to questions. First of all, I think you have in front of you a list of the interests that have been declared by Committee members. This is a formal evidence-taking session of the sub-committee. Full shorthand notes will be taken and will be on the public record, in printed form and, of course, on the parliamentary website. We will send you a copy of the transcript and you will be able to revise it in terms of any minor errors. The session is on the record; it is being webcast live and will be subsequently accessible via the parliamentary website. If, just to get things started, you could state your name and position for the record, please.

James Clarke: Yes, thank you. I am James Clarke of ADAS. I'm the Science and Business Development Manager for one of our business units, we are split into four—I can explain if you like.

Q205 The Chairman: Yes. Perhaps if you could just give us a couple of minutes of general background and then we will come to the questions, that would be very helpful.

James Clarke: ADAS is probably very different to how a lot of people know it, or knew of it. There are now some 500 staff permanently and about another 200 altogether in some sort of short-term, part-time contracts. Primarily, we have four business areas. We have a crops, soils and water area, which is the area I'm responsible for. We have an animal health and welfare area. We have an environment area, which is effectively the non-farmed land, so work for developers, utilities and so forth. Then we have a waste processing part of the

business. But our core area is not that practical bit, it's the applied science, knowledge transfer, use of strategic and policy advice for a wide range of clients from Government to private companies, and very solutions-led really—delivering what somebody wants to achieve and outward-driven.

Q206 The Chairman: Perhaps we could go to the last question first in a way. We're interested to learn what has happened to ADAS since it came out of MAFF in 1997 and the effect this has had on innovation; a couple of points like what was your market share at that point, how does it work now, how effective have you been, the general efficacy of the work you do and how you measure it.

James Clarke: I should say it's very difficult and I'm not sure I could tell you. I don't think there is market share information, but the organisation is very different and we'll come into the different sectors later on.

Q207 Baroness Howarth of Breckland: Could I just say to the witness don't be deceived by the technology? If you could raise your voice a little bit it would be really helpful.

James Clarke: I apologise. I am used to speaking in barns as well. Or if I say something that somebody doesn't understand, please ask.

ADAS is very different and clearly now the biggest difference is somebody is paying for it, not necessarily Government. There's an upfront cost or charge that somebody has to present. We went through a continual process of evolution prior to privatisation where we were charging for some of the work and then we became fully private sector, but essentially if there isn't a marketplace for what we do, we're not going to be there to do it, and that is the most significant change now. Therefore, we have adapted into some new areas of work and others have disappeared. I think that is probably still a misunderstanding for many who think that ADAS is as it was and there are often demands: "We want another ADAS". Well, ADAS is still there with other organisations; it's actually the funding structures that I would suggest people ought to focus more on rather than necessarily the organisations that are there.

Speaking personally, I have no regrets because we're now much more focused on what somebody wants us to achieve and how do we do it. The downside is that means some areas get neglected if there isn't a funding route for them or different sectors do if they're not organised to work collectively through the levy boards or somewhere else.

Q208 The Chairman: How do you measure success beyond being paid for it? In a sense, your market is the market model, so if people pay you, you will do it. In the wider sense, how do you measure success beyond that?

James Clarke: For any work we undertake, we will do a client satisfaction survey of some sort. There are two types of models. There is one where we do a piece of work for a client and they will assess how effective we were under their assessment. The other is where we may be holding a series of meetings or events or a booklet on behalf of a client, and we will then assess that through the after-meeting assessment forms and so forth. Generally, these sorts of presentations and relevance score highly when we do that.

Q209 Baroness Sharp of Guildford: Are there any significant areas that you were working in and in which you're not working now? You say if there isn't a marketplace for it you don't do it. Are there areas where you feel that you were doing valuable work beforehand and you're not doing it now?

James Clarke: I don't think I can think of any. What has happened is the volume has changed. So, for example, in the previous administration, if we go back two years, it then started to change. The economic drivers seemed to be less important. The environmental drivers were very high up the agenda. That has been rebalanced since. So, you could say that the economically-led, performance-led issues have been less so, and I think you have looked at our website. It will change because we are going to talk about securing our food and enhancing the environment; the environment has been in the ascendancy, productivity has been in the descendency, but that is changing, I can assure you.

Q210 Lord Cameron of Dillington: I'm a farmer from Somerset and I've never heard of you. I've heard of ADAS obviously. Are you geographically limited? Where do you actually work?

James Clarke: In the old days we used to have offices in just about every market town. Now we are much more like a nationally managed group of regionally based expertise. So we've got about 10 major sites, for example. Near Cambridge, where I'm based, is the major crops and water area, but we've also got sites in Herefordshire, Yorkshire and Nottinghamshire. I think the livestock area has changed very significantly. A lot of the work we do was for what is now AHDB, the levy boards. And at one time there was a farm at Bridgets, where there was a lot of research going on. Through the changes in structure of funding for dairy research that went down and now there is no Bridgets any more.

On the crop side we do an awful lot for HGCA in the cereals and oilseeds and for HDC such that we are their major supplier of applied research and knowledge transfer. I should say I'm less knowledgeable on livestock because it's not my core area. I apologise for that.

Q211 Lord Lewis of Newnham: I'm a little confused. If you take a subject like waste, which after all is a major problem for the farming industry as a whole, but it's certainly not something that an individual farmer is going to get het up about from the point of view of asking you your advice on it, who motivates the initial idea of looking into waste and what do you do with the information you get? Is it localised for an individual or an individual group of people, or is it then generally sent to a community at large? How do you actually operate at this point?

James Clarke: The majority of what we do will be of a strategic nature or a policy nature. So it might be for Defra, for example, a strategy. Alternatively, we are in one part of our business actually working and processing waste. We're taking waste from industrial plants and from domestic refuse and we are processing it and returning it to land as part of a contract service. Unfortunately, the individual farmer isn't a very big market on their own, as you will appreciate, and therefore there is this mismatch. And I think that's what has in a way fallen out. Many of you will know that farmers don't tend to like to work co-operatively together. There are very successful ones who have done it very successfully, I should say, but there are lots that don't. Then it is going to get neglected because there isn't a big

enough impetus to pay for it. If an individual farmer came along to us and asked us to do a plan or something for them, we would do it. We're doing several in the poultry sector at the moment, which is a bigger business sector, if you like, with much more integration up and down it and led by the poultry producers.

Q212 The Earl of Arran: Under your new organisation, is the take-up from farmers, to ask you a question or advice, less now than it used to be?

James Clarke: Yes. In the arable sector we primarily are providing advice now to independent and distributive trade agronomists and suppliers. We're at that level.

Q213 The Chairman: You're doing wholesale now as opposed to—

James Clarke: No, we don't sell anything. The services we provide are to a person who is then on the farm selling, yes. That model, I should say, has become clearer since we changed. We now actually influence all of that sector, not just where we had our own. Some of the distributive trade didn't talk to us as much because they saw us as competition. So that is a much clearer landscape.

We've done some work with PepsiCo/Walkers crisps, which I think is a classic example of how innovation can happen. Driven by the carbon footprint on their packets, saying, "Can we reduce it?", we have worked through their whole supply chain and had in the same room the factory managers, the agronomists, the farmers, and we looked at how that could be reduced collectively. That has been a really good example of how somebody has driven forward innovation through that means.

Q214 The Earl of Arran: How do you charge out to Mr Farmer nowadays when he comes to see you?

James Clarke: In most cases, somebody else is paying, not the farmer, whether it's a service of advice funded by a levy board, a service or a package of information funded by Defra, or through a commercial route.

Q215 The Earl of Arran: Do you charge out on an hourly basis or per job?

James Clarke: Usually on a time-related basis.

Q216 The Earl of Arran: What are your charges at the moment?

James Clarke: I don't think I'm going to answer that. They vary according to who's doing it, but it is excellent value compared with some other professional services.

The Chairman: Baroness Howarth, I think you had a question and then perhaps you can go on to your—

Baroness Howarth of Breckland: Well, this fits right into—

James Clarke: Could I just quickly say something? Realistically if the marketplace was higher then the investment would also be able to be greater. It is a generally low-priced marketplace in agriculture.

Q217 The Earl of Arran: Farmers can't afford to pay that.

James Clarke: I understand that. One of our pluses is understanding farmers. Sorry, I beg your pardon.

Q218 Baroness Howarth of Breckland: That's all right. It moves into where I want to be, really. One of the things that has been concerning the committee is the pace of change, in this country and in Europe as against some other countries. We've talked to the States and they foresee an increase in agricultural production over the next 10 years of some 40% in Brazil and some 10 to 15% in the US, but something like 4% in Europe. I just wondered, having heard what you just said about the way you've developed your services, whereas previously there was, if you like, total coverage and now there's very patchy coverage from your description—that is what I've heard—how has that affected innovation? Because if the structure of the process is unclear—you may have some nice, clearly focused bits now—but what happens right across the piece in terms of innovation?

James Clarke: I think you're right in identifying that isn't as joined up as it maybe once was. In the 1940s, 1950s, 1960s, 1970s, into the 1980s, it was very straightforward. There was one objective, which was produce more, and it was actually a very simple message to convey as well. Since then, like you, we've identified that actually production levels have stabilised in large parts, not just in the UK I should add. We've actually been trying to get funding for that, to get investigate the causes, and we have so far struggled to do so. But we do think that is an issue of which one question is: what is the degree of support or innovation behind that?

Q219 Baroness Howarth of Breckland: You say in your evidence, "A series of small improvements rather than a major leap forward" and there's continual learning from previous experiences. What if, in terms of how you produce more to feed more people, innovation has to move faster? Would the model that you're describing enable that to happen?

James Clarke: I think it would if we could identify the right mixture—there needs to be enough funding to do it and there needs to be enough integration to do it, and I'm pleased to say that there is currently a tender looking at how integrated advice could work. So that for the first time is balancing what is primarily—and I know there are farmers here. Economics is the number one driver, I don't have to tell anybody that, and in the sustainability that is a pillar of vital importance. It's how do you integrate on the back of that, where do you find the win-wins first, and then how do you address some of the other issues that are more difficult. But in the carbon example I gave you, one of the key drivers for carbon footprint is high levels of productivity, per unit of input from nitrogen, for example. So, they are necessarily different things that will take a long time to bring together.

Q220 Baroness Howarth of Breckland: I think what we've been struggling to understand is whether or not a different model, a more privatised model, as against state intervention delivers more. What I just heard you say is that although you've got some sort of private model, you're actually paid for and delivered by government funding through Defra and other mechanisms. So, in a way, the government funding is just simply delivering a different model. Would that be a right perception?

James Clarke: I think that's probably fair, yes, but the government funding model is also changing. You'll see I've referred to where BBSRC funding is. So I think what maybe was clearer before was that you had one organisation doing it and they were the channel of everything, whereas now there are multiple channels, multiple funding sources, and other people doing the same thing. Competition has been good in that we're now much more focused on what we're doing and what we're achieving, but it creates a more confused marketplace for different messages, different drivers.

Q221 Baroness Howarth of Breckland: We don't have any evidence that tells us whether one is better in terms of total output than the other.

James Clarke: There is no control treatment in this.

Q222 Baroness Howarth of Breckland: Can we just move to another area? One of the other things that we've looked at is the demographic issues and the age of the farmers. What's your view about the impact of ageing farmers, if you like, on their capacity to innovate?

James Clarke: There are some older farmers who have innovated a lot, but there are some older farmers who haven't innovated a lot, and there are some younger farmers. I think one of the differences is the younger farmers have been through an education system which has broadened out from what used to be a very production-focused approach and they've had their eyes opened. All sorts of measures are part of their education package now, such as the way they use pesticides, the way they involve assurance schemes, which are very different to what happened before.

I think there's a mixed source of input. Take genetics. Genetics could apply to the farmers. It could apply to the sector. In poultry, it's very easy to introduce new genetics into the production system very quickly. You've got a much shorter life cycle. But genetic traits in beef and sheep, for example, take much longer to get through if they were clearly identified what they were. Because you've got a more dispersed industry as well in beef and sheep, it's harder to necessarily get those traits identified and brought through as quickly, whereas poultry is a classic example where you've got meat producers driving what they want, or egg producers fed very quickly into the system. I'm not suggesting they're the same, the genetics, but it's interesting that the two actually tend to go together but I think for different reasons.

Q223 Lord Cameron of Dillington: In your paragraph 14 of your written submission, you say it's important that systems are complementary and co-ordinated. Could you explain exactly what you mean by that?

James Clarke: No one person tends to get all their information from one source, and if you're not careful the different sources will be conflicting because there's a slightly different

emphasis put on different parts of it. When you know it and understand it they may actually be the same, but it's very easy for somebody to latch on to the bit they like, maybe the technology in it or whatever it is, and it's easy for them to be confused or the messages to get confused because they are coming from different sources with different emphasis. Therefore, it's the level of understanding behind it that is also important and I think one of the things we've certainly looked at is, "Can we improve uptake of new technology through better understanding of what it does?", which then leads to greater knowledge of why it's going to help the business and what it's going to do, rather than just what the message is.

Q224 Lord Cameron of Dillington: I would agree with that. There are conflicting messages from WAG, Natural England to agronomists. So do you do overall management consultancy for farmers at all, business consultancy?

James Clarke: We don't—rarely do we do that. As I said, this tender at the moment is actually looking at how you integrate different sources together. So I'm optimistic that it's about to be addressed.

Q225 Lord Cameron of Dillington: But you don't have the answers for my question, which is going to be: what is the answer to these conflicting advisory routes into the man at the end of the line?

James Clarke: I don't have the answer. We're writing a tender at the moment. I'm optimistic that will—we're obviously competing with others as well, so that could provide a platform to do exactly what you're trying to identify.

Q226 Lord Cameron of Dillington: Are you allowed to say who the tender is for?

James Clarke: It's for Defra.

Lord Cameron of Dillington: It's for Defra, right.

Q227 Baroness Howarth of Breckland: Would they would pay for it?

James Clarke: They would pay for it, yes.

Q228 The Chairman: What percentage of your revenues is government-funded, in one form or another?

James Clarke: I haven't got the figures to hand. I could find out and let you know.

Q229 The Chairman: Could you write to us? If you've got a guidance number and then write in with the exact number?

James Clarke: It's less than half. Well, Defra and its agencies, so including the Environment Agency, for example. It will be somewhere around a quarter to a third.

Q230 Baroness Parminter: In your submission, you talk about some sectors which are less technically inclined than others and cite others which are more prone towards innovation such as potato and horticulture. In light of limited public resources, where do you think the extension activities should be directed—to those which are more innovative or those which are less innovative but could deliver more benefits long term?

James Clarke: I thought it was a really interesting question. In the classic innovation process—you look at the innovators and early adopters first and then you hope the others follow. I think what I would say is that the more innovative sectors are probably where you need to make sure the right policies are in place, the right structures, and my example of the carbon footprint driving some of that is an example of where that has stimulated a change. But the less innovative sectors, I don't think you can separate out what effectively needs to be a structural reform from the way in which the message is, or how much effort you put into the message and what you communicate to them. Because what is lacking very often in some of those is the driver for change, and if you focus just on what you do and put resources into what you're trying to communicate without the structure into which you're trying to communicate that, then I don't think that will be very successful. Is that helpful?

Baroness Parminter: A bit, yes.

Q231 Lord Lewis of Newnham: You yourself are concerned with soil, crops and water. Now, if we take water, which is quite clearly one of the major problems of the immediate future as far as not only agriculture but many other things, what is the driver that makes you actually go to look at water and soil? Do you have to wait until somebody comes along and makes a request for a certain type of survey, or are you actually looking at the general problem over water, the possibility of getting crops which have a much higher demand for water and things of this nature?

James Clarke: The latter more. We used to have crops separate to soils and water. We brought them together on the 1st of October, because we could see that looking at them together is where agriculture needs to be. What we are trying to do is identify and go out with proposals to stimulate opportunities where we believe there could be better use of plant breeding to be more water use efficient, for example. So we are moving now proactively on water use and water use efficiency. To date, most emphasis has probably been on water quality, driven by EU directives, as you'll be very familiar with. The balance is between how much are you playing catch-up and how much are you trying to be proactive. Obviously, there's a balance in everything we do between those two.

Q232 Lord Lewis of Newnham: But what's your incentive to do this? If you are primarily financially obliged, do you get this idea and then sell it to Defra or do Defra come to you and say, "This is the idea we want you to pursue"?

James Clarke: There's a bit of both. Our ideal is to be proactive about making suggestions which may then go out to tender, we recognise that, but I know all of our scientists are driven by pushing things forward and trying to increase the innovation and the appliance of that science, rather than just being reactive. They want to be at the boundary and enabling new technologies and seeing how they can get into the marketplace.

Q233 Lord Lewis of Newnham: So what is the situation in this country as far as soil is concerned? It strikes me in certain of the things I've looked into that the number of people involved in looking at soil has been decreasing over the last two decades. Where do you see that? Because this must be a critical feature in many of the areas in which you're involved.

James Clarke: There are certainly fewer people than there were. However, I'm very pleased to report that I actually looked at some age profiles of our own staff and I can assure you that we have a very good profile in soils. We have a very good profile in water, in several other areas. There are two where our profile isn't so good and we have recruited effectively into those areas to deal with just these sorts of things. But there aren't the number of people and there is certainly some experience that will not be available soon. There are people still who are retired working in that area and encouraging others to develop their own skills.

Q234 Lord Lewis of Newnham: So what do you do about this, the fact that there is, as you say, areas in which you have a deficiency? How do you activate people—

James Clarke: Well, we've recruited. I'm managing a group of 18 new recruits at the moment in ADAS with exactly this, looking to the future, in mind. What I should say is they don't come in with agriculture or soil science degrees anymore; they come in with biological or environmental sciences and we then have to put the soils or the agriculture into them. That is a change that we've had to make.

Q235 Lord Cameron of Dillington: How do you get the interest from the farmers to actually pay for your services? A lot of farmers are blindly unaware of the damage some of their operations are doing to their soils in my experience.

James Clarke: I think you're having AHDB appearing before you at the committee. HGCA as part of that have identified soils as one of the areas they see as important for the future and they're about to publish that report. Their research priorities will focus on soils, and the Potato Council has just commissioned some work in that area. They're a farmer-led research committee, so I hope it is coming. The question is, "What do we need to do and how we do it?"

Q236 Baroness Howarth of Breckland: Chair, I have a question that might focus this. I can see the part you're playing in all of this, but where is the strategic vision? Is that at Defra somewhere or somewhere out in this community? Where do you link up with a strategic vision which says, "Unless we do something about our soil, unless we do something about our water, we are going to be in serious difficulties, never mind all the other technical innovations or genetic innovations that we might have". How do you fit into that framework?

James Clarke: We have to go out and try to persuade other people that this is important, if it isn't already important. We have to try to put the right proposals to people to say, "This is what we could do, what we could achieve". But if they don't see it as important as we do or we can't persuade them of the importance, it won't happen. There are other people also influencing what their priorities are.

Q237 Baroness Howarth of Breckland: But are Defra not saying to you, “This is a problem. How are you going to play your part?”

James Clarke: In the old days, Defra, or MAFF as it was, and ADAS were one and the same. That isn’t the case any more. We are a private contractor just like anyone else and, therefore, they can’t give us any inward sight over anyone else.

Q238 Baroness Parminter: Forgive me, I’m new to the committee so this may seem be a bit naïve, but ADAS, as it was, used to be basically about extension activity, and that’s not what you’re about. You’re obviously doing a good job as a private consultancy and I commend you for the PepsiCo stuff which I saw in the papers and is an excellent initiative but it’s not extension activity. Have you, as a business, seen that as a gap in the market and made a bid to Defra for providing some form of extension activity support? Because that is an issue I would like to tease out.

James Clarke: Firstly, I think there are a number of definitions—I think what we did for PepsiCo is extension but it’s for a private client. It’s not necessarily for—now, maybe Government—it depends who you think should be doing extension, but it’s focused on that client’s or that organisation’s needs and who’s funding it. Yes, we have identified with Defra and others the need for extension, knowledge transfer—same thing—but it is an area which is probably less well funded, although they do fund initiatives through Natural England, such as the catchment-sensitive farming, for example. But again, they tend to have a driver of a focus on protecting the water quality or parts of the environment so they tend to be issue-specific.

Q239 The Chairman: Perhaps this will come, but I think I am slightly lost here. Who is doing extension work? You used to do extension work. Who does it now?

James Clarke: Well, if I explain to you some of the things we do, perhaps that—

The Chairman: No, if I may, I’m much more interested in—

James Clarke: We do extension for levy boards.

The Chairman: I think the question is for the individual farmer. You seem to have now gone to an intermediated service where you’re selling your skills to people who do the work. I think we’re curious if about what’s happening in the extended service. Can you just talk about that?

James Clarke: Are you saying who’s giving the on-farm advice?

The Chairman: Yes.

James Clarke: Sorry, I apologise. In the arable sector that is given by independent agronomists. There are a very large number of independent or distributive agronomists. We have provided them with information and I think that is an area which is pretty well served for that, which is what you’re referring to. In other sectors, in vegetables and horticulture, for example, and in potatoes, then there are agronomists working for the buying groups, for organisations, for supermarkets as well, which are providing some of that information. Some of the big producers have their own agronomists. Increasingly, what we see as well is that a lot of farmers are trained into being their own agronomist. A lot of that has probably been also driven by the voluntary initiatives in improving levels of pesticide use, for example.

There are in the dairy sector independent advisers who will work on the farm for dairy. In beef and sheep and dairying and pigs, there is an extension service or part of the knowledge transfer which is directly run by the levy board. They're out on farms. In the case of cereals, oilseeds and potatoes—crops rather than the animals—they organise events which are often very specific, produce information, but they're not in the same degree on farm. Those three are contracting in the likes of ADAS or other organisations to do those sorts of jobs on their behalf. So I hope that answers it. They are different in different sectors.

The Chairman: It took us a long time to get it.

Q240 Lord Cameron of Dillington: Can I just follow up on that? It was really Lady Howarth's question. Is Defra taking a strategic view of this picture of what might or might not be missing? You answered another part of the question. I just wondered—

James Clarke: I can't say that I'm aware that there is one. I think the levy boards are trying to address it.

Q241 Lord Lewis of Newnham: I think what you're saying is the people who are offering advice in a sense have a vested interest, and that's what worries me about this. It's the sort of advice you get which you genuinely believe is giving you all the various alternatives. With no disrespect to people, they tend to give you their side of their coin.

James Clarke: I totally agree, but it's whether they're promoting the environment or a particular part of the environment, a particular group of birds or whatever it is. There is always some area that they're coming from that is more important, if you like, but there are some very good people who will give you balanced information. And there are independent agronomists, on cereals and oilseeds in particular, where it's got to be cost effective for them to be going to do that part of the business. So, there is some bias in everything.

Q242 The Earl of Caithness: Two very quick questions for you, Mr Clarke. Is your work UK-wide or just in England and Wales? Secondly, I remember when I was a surveyor how helpful you were to farmers on the ground, at ADAS then. Do you think that is a major drawback now that you don't have the contact with farmers that you used to have?

James Clarke: The first question was about the UK. We are primarily England and Wales, although a lot of what we do for some of the levy boards, for example, is into Scotland as are some of the other commercial clients. We do some work overseas—Australia and New Zealand on crops—and we've done pineapples in Ghana.

Secondly, I hope we're still helpful to farmers but it's in a different way. It's not so much in the one-to-one guiding them on the farm, it's providing them with more strategic information, either directly or through a third party, upon which they can make their own decisions. But the thing that has changed, really, is that sort of degree of government-funded help individually for their own businesses has changed.

Q243 The Earl of Arran: Turning as ever to the role of Government, you called for a co-ordinated approach to what data Government needs to assess innovation. In your opinion, what data does Government need?

James Clarke: I think I've probably written my answer badly. I think what I was trying to indicate was that Government already collects quite a lot of data from farming. Sorry, I was suggesting that the improved ability to make decisions is something that would help on the farm and balancing the different objectives from the environment, the economics and all the rest. What usually makes those systems fall down is that they require data to drive and make them and nobody wants to be putting in data they don't need to put in, or that they've provided it to another source in a slightly different way. So if the information on crop areas and the RPA single farm payment was integrated with some of the information that you need to make better decisions on the farm for nutrient advice for example, if there was an overall view about how that would look together and, therefore, one set of data could be used for multiple sources, it would actually drive the ability to deliver those sorts of tools that were taken up because people could see it's using my data—something I'm already providing to Government but which are helping me with my business.

Q244 The Earl of Arran: What you're suggesting, can you ever see it happening?

James Clarke: I think that probably the biggest barrier is people's concerns over data protection, but I would like to think it was possible because there are on-farm computerised systems which actually can already be interrogated to give information such as is collected by Government on pesticide usage, for example. So it's technologically possible given the vision, but acceptability would be a political issue.

Q245 The Earl of Arran: And the second question is you say that innovation in agriculture is often done by word of mouth and the credibility of the source is very important, but does it not militate against a Government-led approach and more towards one that's driven by the industry at as local a level as possible?

James Clarke: It requires one that is appropriate for whatever that business is doing, and I think one of the reasons that it's stumbled in the past is that the push has all been about the environmental drivers but there's been no balancing of what the economic implications of those would be. We've seen, for example, introductions of pesticide legislation and buffer zones which weren't integrated with what farmers were required to do on environmental schemes. The two could have come together and solved each other's problems and that would have then been economically driven as well. It is this integrated—I actually think balance is a better word than integrated—balancing different priorities to come out with the optimum that actually keeps everybody happy. But what we have to realise is you can't deliver everything everywhere. There will be areas where we're delivering food; there will be areas where we're delivering certain plants or wildlife or whatever.

Q246 Lord Giddens: Can I just introduce the EU into this discussion and just ask what you think the optimum balance would be in terms of innovation between national Governments, the EU and agricultural industry? Where would you strike the balance between these? Can you give any concrete examples of where it works and where it doesn't?

James Clarke: Well, I'd refer you back to my examples where it's worked in things like poultry, like potatoes, where you've got this vertically integrated supply chain. There's no doubt that assurance schemes have driven change as well. Now, if that could be done at EU level so be it, but often there is an awful lot of diversity in different farming systems, soil types, climates, which needs to be overlaid. In effect, most of the thinking is now coming back down to a catchment level—partly driven by water quality, I realise, but it's down more at that level. I should say one of my areas is pesticides. I'm chairman of the Pesticides Forum in the UK. I believe, for example, on pesticides we do need to be thinking about catchment-based approvals, whereas the EU legislation is very much about EU-wide approvals. So, if you're not careful your assessments are then done at worst case and you don't have the ability to use it in places where it really is valid. So, that's not a real answer, I'm afraid, but I hope it has illustrated some of the complexities.

Q247 Lord Giddens: You couldn't see a connection between your Walkers crisps illustration and EU policy on climate change, for example? The EU is trying to be in the vanguard.

James Clarke: Sorry, policy drivers, yes. Some of these are international. For climate change EU is too small as well, isn't it? But the policy drivers will set the landscape into which people are going to change, and it's what is that balance and what is appropriate for—

Q248 Lord Giddens: In the case of Walkers crisps, were they informed about what the EU policy is on the issues which they were interested in? Because we need to find a way forward in Europe in reducing carbon footprint in agriculture and innovation in agriculture is a very big part of that. I think it's quite an interesting little illustration of Walkers crisps, driven by the business risk.

James Clarke: Yes, ultimately most of these are driven by business risk. "What are the risks to my business?" has got into it and now—

Q249 Lord Giddens: But something caused them to want to reduce their carbon footprint?

James Clarke: I think what we tried to do is actually—I think carbon footprint actually integrates a lot of different things for the first time. Carbon and carbon dioxide equivalent brings together lots of fairly complicated types of—and productivity, for example, is immediately integrated with output per unit of production. So, I think they also were driven by what is the risk for water availability, for example. So it's immediately going wider than carbon, which I can't quite answer why they've put a carbon footprint on their packets which they then wanted to get reduced, but it was driven by the risk to the business and how they're going to ensure that where they've got factories they've got potatoes, where they've got—and how are they going to be in business in the future.

Q250 Baroness Sharp of Guildford: You talk about the need for rebalancing between applied science and knowledge transfer, and you suggest that one possibility might be for

some of the BBSRC funding to be made available to applied scientists at the knowledge transfer organisations. Have you put these ideas to either Defra or BBSRC?

James Clarke: We've tried to. The reality is that in the case of BBSRC we have struggled to get the right point of contact, I think, probably, which is that currently organisations such as ourselves, such as NIAB, who I think you'll be talking to later, are not eligible for those funding sources. It's very much driven by the science rather than the application of the science, together with the funding rules. If you could help me do it, I'd be very pleased because I think we've got a lot to offer. When the emphasis changed from plant science to crop science, for example, we've been growing crops for a long time, not just plants, and applying it and we believe that with a small amount of that funding we would be able to make a huge difference to the way in which that became relevant output, outcome driven.

Q251 Baroness Sharp of Guildford: There are now relatively few departments of agriculture in universities, but do you work with these?

James Clarke: We work with a lot of collaborators in a lot of areas, whether they're universities, other organisations doing similar things, skills with environmental, social scientists or whatever is appropriate to the particular piece of work.

Q252 Baroness Sharp of Guildford: Obviously one of the organisations that you've worked with is the AHDB. From what you've been saying, on occasions they are commissioning you to do work, but do you work in partnership with them as well?

James Clarke: We do, yes. We certainly do and we have a long-standing relationship and trying to understand each other's issues. I think ADAS is one of the few organisations who cover the whole range of the AHDB portfolio as one organisation. So, yes, I personally will be speaking to them on an almost daily basis for various reasons. Yes, there is a lot of interaction.

Q253 The Earl of Caithness: Mr Clarke, could you expand on your sentence in paragraph 14, "It is also important to note that different approaches are likely to be required for different sectors and possibly for different individuals within sectors" and how you might solve that problem?

James Clarke: Well, to some extent I hope I've covered the sectors, have I? Or do you feel I haven't, with potatoes and poultry at one extreme?

The Earl of Caithness: You've covered a bit of it, yes.

James Clarke: So if I pick up some of the individuals, perhaps, I think that would help. Because there is no doubt that different individuals are motivated by different things. In most cases, economics is an important driver but it's not for everybody. What I think is often neglected is that for many—and probably beef and sheep are the ultimate—sectors, farming is not only a business, it's also the social aspects, the lifestyle, and it's everything wrapped up in one. That is the life and I think what is therefore important is that some of the other factors in terms of passing that family farm on, et cetera, are just as important drivers for those businesses as it would be for somebody who wants to supply their crop to a particular supermarket meeting a certain specific standard.

Q254 The Earl of Caithness: So far as agriculture is concerned, how do you feed the information sensibly with regard to innovation, down to that group of farmers, separating the social requirement of keeping the countryside viable and attractive, the south manicured and the north wild.

James Clarke: And some of them are motivated by that; that actually is the motivation, what the farm looks like. But I think what is absolutely vital is that the person delivering the advice or information understands, first of all, what the drivers for change are in that particular business and, importantly, also who is the driver for change in that business. It may not be the person you're talking to, it may be their son or their wife or their husband or whoever it is. Somebody is that motivator for change and effectively the person who really makes the decisions. And these are skills that some of us have learnt over years, they're not unique to agriculture either.

Q255 Baroness Howarth of Breckland: What if there isn't anybody? Is it right that we continue to have a situation where hill farmers managing sheep live below the poverty line because they like the way of life? Where would the driver be in those sorts of situations where you can see the way life is moving, the way economics are moving and the pressures on changes in the way funding is going to come, there is going to have to be change anyway. What do you think those drivers should be and does your organisation have any input in that kind of issue?

James Clarke: Really not a huge amount, no. We will identify them but what we will do is work with people who want to make those changes happen in terms of whether it's Defra saying they want to change something. I think it comes back to my point that structural reform is as important as the innovation itself in some of these sectors. It's not for me to say whether it's right they have to change if they want to stay like that. It's a choice decision that people can make as well, any of us.

Q256 The Chairman: Well, I think that's it. We're very grateful. I think it has helped many of us clarify what ADAS does now. Your opening comments were very good in setting the scene because I think many of us thought back to what it was and I think we're leaving this with a much clearer idea. Thank you very much.

James Clarke: If I've helped I'm grateful. Thank you very much.

National Institute of Agricultural Botany (NIAB) and Professor David Leaver

Written evidence from NIAB (IEUA 28)

Introduction

NIAB spans the crop development pipeline, combining within a single resource the specialist knowledge, skills and facilities required to support the improvement of crop varieties, to evaluate their performance, and to ensure these advances are transferred into on-farm practice through efficient agronomy.

The need for innovation in plant breeding and agronomy has never been greater. With a growing global population, agricultural science and technology has a vital role to play in boosting food crop productivity, conserving resources and coping with climate change. A unique national resource, NIAB is well placed to contribute solutions to these challenges.

Definition of ‘innovation’ in the agricultural context

NIAB agrees with the interpretation of innovation as a combination of factors, referring not only to dimension-changing effects such as the introduction of entirely novel techniques or technologies, but also to incremental advances in existing products and practices, and to the processes of knowledge exchange through which such progress is more widely adopted throughout the agricultural sector. NIAB is involved at all stages in the innovation chain.

Innovation in EU agriculture as a strategic objective

NIAB firmly agrees that innovation in EU agriculture should be pro-actively encouraged. The challenge for 21st century agriculture is to double food production over the next 40 years, on a finite amount of land and using increasingly scarce and costly resources.

Furthermore, climate experts predict that growth in the world’s agricultural production will become increasingly dependent on temperate regions such as northern Europe as climate change affects crop yields and water availability in sub-tropical regions.

Achieving a sustainable intensification of EU agriculture – producing more food using fewer resources and with less environmental impact – will depend on access to the latest scientific and technological innovations.

This in turn will require proportionate, science-based regulation of such advances, as well as the existence of a functioning, properly resourced R&D chain capable of delivering new technologies, products and production systems from basic research through to practical on-farm application.

Innovation today

UK plant breeders have been extremely successful in delivering a flow of improved crop varieties to UK farmers with higher yields, better pest and disease resistance, and enhanced end-use quality. Novel crops, such as forage maize, have also been adapted to thrive under UK growing conditions.

A recent NIAB study conducted for the British Society of Plant Breeders concluded that plant breeding accounted for 90% of the yield gains in UK wheat from 1982-2007, compared with around 50% from 1947-1982.

There is no doubt, however, that the rate of yield improvement has slowed in recent years. A major limiting factor is the lack of resource available to introduce novel genetic variation and germplasm into existing breeding programmes, a situation NIAB is seeking to address.

Obstacles to innovation, Future challenges driving innovation forward, Knowledge transfer

The UK has a strong science-base in laboratory-based plant science research, supporting continued advances in our basic understanding of the plant genome and the functions of individual genes and gene sequences.

These advances open up major opportunities for radical, dimension-changing developments in plant breeding. Improved understanding of the photosynthetic process, for example, could allow conversion of C3 crop species such as wheat and rice into more productive C4 crops such as maize. The development of apomictic crops – allowing asexual reproduction through seed - would enable desirable traits to be maintained year after year, with no loss of hybrid vigour. The introduction of perennial cereal crops would result in reduced inputs and other environmental benefits.

Exploiting these opportunities, however, will require a fundamental shift in research funding and prioritisation.

Understandably, much of this pioneering plant genetic research takes place in model crop species which are more amenable to experimentation. There are concerns, however, that little of the knowledge generated is being transferred to useful crop plants, and **there is a general failure to recognise the significant research effort and particularly the resource required to translate important discoveries in simple crop species such as cress and mustard into more complex, commercially relevant genetic backgrounds – eg wheat, barley and oilseed rape.**

Currently there is no established or consistent mechanism within the public sector to ensure that important research discoveries in basic plant science are taken through to practical application at the farm level. This is because commercial plant breeders – who provide the only route to market for improved crop varieties and traits – do not have the financial capacity to invest in speculative or long-term research, and public sector support for more applied, translational work such as this has been progressively withdrawn since the mid-1980s.

The need to strengthen the delivery pipeline to take the findings of underpinning plant science research through to practical application by plant breeders was highlighted more than five years ago in a major BBSRC review of UK crop science in 2004 led by Professor Chris Gilligan of Cambridge University. While measures put in place, especially by BBSRC, since Professor Gilligan's review have certainly helped strengthen links and interaction between public research and commercial plant breeding sectors, the lack of public sector investment in essential translation and pre-competitive breeding activities remains a major block to the delivery of step-change innovation in the key arable crops.

To put this into the context of a recent example, consider the announcement in January 2010 by the John Innes Centre that scientists studying the *Arabidopsis* genome had identified genes of importance for coping with temperature change.

Such information could be extremely valuable for the development of commercial crop varieties capable of withstanding greater extremes of climate change, yet there is no obvious next step or route to market for such a discovery. Uptake would currently rely on a commercial company being prepared to invest in this early stage prospect and as noted above, the capacity of the breeding sector to invest and take risks is limited.

The widening gap between our basic understanding of plant genetics and our ability to apply that knowledge in practice presents a compelling case for public sector funding to bridge the gap.

Working in partnership with other research institutes – John Innes Centre, Rothamsted, IBERS - NIAB's is seeking to re-connect the R&D pipeline by providing a dedicated pre-breeding platform capable of translating basic genetic discoveries into material suitable for use in commercial plant breeding programmes.

This innovative programme will provide a delivery mechanism allowing novel traits and associated marker technologies to flow from publicly funded research through to exploitation in commercial breeding. Trait genes and markers will be validated and assessed in pre-competitive germplasm, adapted to UK conditions, and made available for use by commercial breeders and other research organisations.

NIAB has already made significant progress towards that goal, with a £1.25m investment in laboratory facilities, equipment and growth rooms at its Cambridge site. Over the past two years, a team of more than 30 highly-skilled scientific staff, including three plant breeders, has been recruited.

The building blocks are in place, and already NIAB has secured a number of short-term research contracts – both independently and with other research partners – which serve to illustrate the pre-breeding skills and capability on offer. These include pioneering projects to re-synthesise the hexaploid genome in wheat, and to select for more climate resilient cereal varieties.

The challenge now is to establish a secure funding base which will safeguard the medium to long-term future of the centre and the team behind it as a vital resource in support of plant breeding for the public benefit.

Demographic structure of the sector

There are widespread concerns within the agricultural research sector over the lack of new blood coming through to succeed a generation of applied agricultural scientists now reaching retirement.

There is a strong view that researcher career paths – and project funding priorities - have in recent decades been driven and rewarded more by scientific publications than by practical research impact.

The need to attract and recruit new scientific talent to support innovation in agriculture is reflected in BBSRC's new plant science MSc and Advanced Training Partnership (ATP) initiatives, both of which are supported by NIAB.

As a training organisation, NIAB provides a range of courses across virtually all aspects of crop production – from seed sampling, testing and inspection through to the latest methods in plant breeding and quantitative genetics. The practical focus of NIAB's role as a training organisation is now virtually unique among UK plant research institutes, yet the need to strengthen links between research and productive agriculture is viewed as essential to meet future policy objectives.

In addition, the establishment of a pre-breeding initiative at NIAB presents a significant opportunity to provide genuine career opportunities for applied plant scientists motivated less by 'high science' publications than by delivering practical impact and innovation on the ground.

Knowledge and innovation systems

We agree that networks embracing researchers, consumers, producers, retailers, advisers and government are required, and it is vital that retailers are fully engaged as they provide the final, highly trusted conduit for the results of innovation. These networks are required to champion and promote innovation and best practice in the retail food supply chain. This would include generating and disseminating impartial, science based information and advice in a variety of formats, and might include, for example, variety choice, grower and storage protocols, benchmarking carbon efficiency in the wider context of sustainable efficient production, taking into account the effect on other resources such as water, land use and energy.

To ensure relevance, these networks need to be driven from the commercial sector, not imposed by government or the research base.

Research and Development

The research agenda should be established by formal networks facilitated by government, embracing researchers, consumers, producers, retailers, advisers and government.

To drive innovation, partnerships between the public and private sector are highly desirable, particularly in translating science into practice. An important element of this is the recognition of non-cash inputs by the private sector.

Education and skills

It is generally accepted that there is a lack of skill in the sector, and we are confident that colleagues in the educational and charity sector will respond robustly. The situation is urgent in some areas such as that of practical agronomy, and government should consider supporting short-term apprenticeships for graduates wishing to convert their skills to practical knowledge.

EU policies

In addition to the decline in public sector support for translational and applied agricultural research, **the EU regulatory environment is more disabling than enabling in its treatment of agricultural innovation.**

A near total block on new GM crop approvals for cultivation within the EU is the main reason for a stagnation in GM crop research activity over the past 10-15 years, and a lack of private sector investment in GM crop trials and development. The EU has also introduced a restrictive new approvals regime for pesticides, replacing the current system based on scientific assessment of risk with new 'cut-off criteria' based on perception of hazard. This is expected to result in the loss of many important crop protection products with a track record of safe and effective use in EU crop production.

October 2010

Oral evidence, 12 January 2011, Q 276-321

Evidence Session No. 8. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
The Earl of Dundee
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witnesses

Witnesses: **Dr Tina Barsby**, [Chief Executive and Director, National Institute of Agricultural Botany], and **Tony Pexton**, [Chairman, NIAB Board].

Q257 The Chairman: Dr Barsby, Mr Pexton, welcome and thank you for attending today. I shall deal with the formalities before we start. You have a list of interests that have been declared by the committee. This is a formal evidence-taking session of the sub-committee and a full shorthand note will be taken. This will be put on the public record in printed form and on the parliamentary website. Of course, we will send you a copy of the transcript, which you can revise for minor errors. The session is being webcast live and will be available on the parliamentary website. For the record, it would help if you could start by giving your names and positions and we can then get on to the questions.

Tony Pexton: I am Tony Pexton. I farm in the East Riding of Yorkshire—arable farming and pigs, and I am chairman of NIAB TAG the genetic plant research company in Cambridge. I will leave Tina Barsby to introduce herself.

Tina Barsby: I'm Dr Tina Barsby, the director and chief executive officer of The National Institute of Agricultural Botany and NIAB TAG.

Q258 Lord Giddens: I welcome you and thank you very much for coming to give evidence. Can I start by asking about innovation and productivity? We heard from US

witnesses that agricultural productivity in the EU may increase by about 4% compared with 10 to 15% for the US, and apparently 40% from Brazil—presumably starting from a much lower base.

In your evidence you say that, “while plant breeding accounted for 90% of the yield gains in 1982-2007, the rate of yield improvement has slowed in recent years”. I have two questions: how do the yield gains in UK wheat in recent years compare with other EU countries and with countries such as the US and Brazil; and in what sense does it matter if these gains have slowed in recent years? Is it mainly concerned with food security, international competitiveness or some other element that makes that a source of worry?

Tony Pexon: I think there is a great deal of evidence that yields within the UK and other EU countries of wheat and rape, which are our main crops, have plateaued in the past eight to 10 years, whereas the evidence shows that in other countries, particularly in Brazil and America, those yield increases have continued.

Q259 Lord Giddens: Could you say a bit about that remarkable figure from Brazil? Does it mean just starting from a very primitive base?

Tony Pexon: I would suspect that their management techniques have improved over time. I cannot give a definitive answer but the evidence is there that this has happened. I suspect it is your supposition that they started from a slightly lower base.

I believe it does matter very deeply that this has happened, because in the context of climate change Europe, and particularly the UK with its maritime climate, is predicted to be less affected in its productive capacity in the future as climate change gets hold. We are all aware of the predictions of the necessity for increasing production from land—more production from less inputs of land, energy, water and fertiliser. The fact that our yields seem to have stagnated is tremendously important from a food sustainability point of view. We are not talking just about the UK but Europe and the world. There are predictions that large parts of the world will become far less capable of producing even the amounts they produce now, as a result of climate change in several years’ time. So I believe it is very important that we address this problem.

Q260 Lord Giddens: I don’t want to interrupt you, but could you say why the US seems to be more successful?

Tony Pexon: Again, I would suspect management techniques, but I also strongly suspect genetic modification and the adoption of that technology has had a significant impact on their yield increases. There is evidence to show that the continuation of yield increases in the States has coincided with the introduction of GM technology, whereas in the past eight years, Europe’s yield has plateaued.

Q261 Lord Giddens: Does this apply to the EU as a whole, or are some countries within the EU doing much better than others?

Tony Pexon: This applies to the EU as a whole, but some of the former eastern countries that are now members of the EU will, I suspect, see their yields increasing because of better management, infrastructure, etc. If we take the EU and the UK as a whole, all the evidence is that our yields of wheat and oilseed rape have plateaued in the last eight years.

Q262 Lord Giddens: Do you want to hazard an explanation for that?

Tony Pexton: I think it is very difficult, frankly. Despite the introduction of better genetic material, we might have reached the limit of viability as a farmer and our disease and pest control abilities. But also, price restrictions have made me watch my inputs very carefully.

If your prices are low, there is a much lower input level of fertiliser, for example, to make sure that you get the value of that last input. Total yield and economic yield are not necessarily the same thing.

Q263 Lord Cameron of Dillington: I want to turn to biotechnology. I wonder whether you could let us know what opportunities you think are being missed vis-à-vis genetic modification and other forms of biotechnology within the UK.

Q264 Tina Barsby: As a supplementary point to Mr Pexton's response to the previous question, if we look at what has happened to productivity in North America and Brazil, and the EU, it is not just differences between countries but on a crop-by-crop basis. So, in wheat, where there is no commercially grown GM crop yet, you don't see those sorts of productivity increases, even in the US that we see in crops like soya bean and maize.

Because the technology has so far not been applied in our major crop—wheat—we are missing out totally on capabilities in that, but if you look at what has happened in our next most important crop, oilseed rape, in other countries, notably in Canada, herbicide-tolerant canola has been used, allowing minimum till regimes, which are demonstrably much better for the environment as a whole. You have the technologies that are currently applied in maize and soya bean notably, which could be used in our crops, but aren't. Things which would help agronomy, such as herbicide-resistance and disease-resistance, and then the things which we know are in the pipeline for maize, the most important of which is drought resilience, which will be available in maize fairly soon. But there are others. We can make improvements, obviously, through conventional plant breeding without using genetic modification but to make the major step changes that we have seen in maize, soya bean, cotton, to do things such as improving nitrogen efficiency and photosynthetic capture at a high level, and thereby increasing productivity, we will need genetic modification.

Lord Cameron of Dillington: So what would you hope to be done within the EU to have an enabling regime? If, as we heard last week at the Oxford conference when Mr Ciolos said that it all has to be agreed by the public first, how will we persuade the public on GM?

Tina Barsby: There are two or three questions there. We would call for science-based regulation and decision-making. Look at how long GM products are taking to come through the EU system. We are aware of a blight-resistant potato which is ready to be launched and would reduce substantially the amount of pesticide sprays that would be used on that crop in this country. But our confidence in seeing that come through the system, given that the last potato product took 13 years to come through the system, is not high.

Because political issues get embroiled with the science there is a timing issue.

Q265 Lord Cameron of Dillington: Who should be persuading the public? How are we going to persuade the public?

Tony Pexton: I have a personal feeling that the anti-GM movement is not quite as acerbic as it used to be. This is partly because there is a recognition that we need every tool in the toolkit to face the challenges that we will have in the future for food production. There is also an acceptance and acknowledgement that there are environmental concerns that must be addressed, so GM need not necessarily be purely about yield. It can be about addressing

efficient use of nitrogen, water or sunlight, as well as the things like pest and disease-resistance.

A whole range of issues can be addressed by new technologies, and some of these are becoming more important than they were five, eight or 10 years ago. That might help to address the current, slightly diminishing anti-GM feelings in the population.

Tina Barsby: I could add that I feel, after a long involvement in this, that Government need to take a lead.

Lord Lewis of Newnham: I'm sure you are right. With no disrespect, if you were to put the case it would be a vested interest. It has to be somebody who is seen to be neutral.

Q266 The Earl of Arran: Turning to the critical subject of research, you have been pretty scathing about some aspects of research and have called for a fundamental shift in research funding and prioritisation.

I have three questions on this point. Are you saying that current research and the amount we spend on it is a waste of money and time? Secondly, what effect if any, do you think that the BBSRC support for research has? Thirdly, do you have confidence in the competence of Defra, BIS and AHDB in determining research priorities?

Tony Pexton: Could we each of us answer part of that question according to our own knowledge and involvement? As a farmer, and ultimately a consumer of research, one of my concerns is that the pipeline from the basic research of genetics through to me being able to use the results of that research in my fields is not as efficient as it used to be.

As NIAB TAG, we are addressing this pipeline. We have genetic research at one end and infield operations and KT at the other end. It is not necessarily a question of research funding and prioritisation, but a question of more emphasis being put on to the knowledge transfer part, because knowledge is no good unless it can be used by those who benefit from it. It is the knowledge transfer that concerns us. We are addressing that in a small way on an industry basis with our tie-up with the arable group. They are more infield-based and we are research-based, but we have started to re-establish that pipeline. It is funding to get some of the basic research into practical application that is, in our estimation, lacking.

Tina Barsby: It also depends how you judge research. If you judge it on the basis of how internationally recognised or competitive it is and the potential that it may have to make improvements on farming and in the wider world, there is no doubt that the BBSRC funds a large amount of high-quality science, which delivers on the measure of effectiveness that has been used in the past. However, as a scientist who is on the periphery of basic research and has been for some time, I think that what is missing are overall research targets set by government or government-advised bodies. We don't have objectives for scientists that say that we are aiming, for instance, for a 50% in wheat yield in the next 10 years and to give our scientists some umbrella under which to fit their research.

Some of them won't want to work like that. They do blue-skies research and they should be allowed to continue to do that. But there are a number of world-class scientists who like to have general applied targets. There is a slightly different point. We still need the knowledge transfer and some general targets. This is where we would like our agriculture to be

The Earl of Arran: Who would help the Government set these targets? Which particular bodies?

Tina Barsby: I would think Defra would be in a strong position.

Q267 The Earl of Arran: You regard them as competent to do so?

Tina Barsby: Yes, with advice.

Q268 Lord Cameron of Dillington: How does the NIAB's funding work?

Tina Barsby: I can give you a bit of history. NIAB was founded in 1919 by charitable donations. It has always been associated with the Ministry of Agriculture. Up until 1996 it was wholly funded by the Ministry of Agriculture—now Defra. At that point it was privatised. We are now a not-for-profit charity, so all our funding comes from competitively won contracts. We have no core funding. We do national variety testing under contract from Defra which is still our major customer, but that is about 25% of our funding now, whereas in 1996 it was 100%. We have must more industrial and competitive funding from other government agencies. It is one thing to be in the right place but the funding has to be there.

Q269 Baroness Sharp of Guildford: The implication from what Mr Pexton said in your remarks was that you feel that there has been a deterioration here and that there was a time when there was more link-up here and better transfer. Could you tell us a little bit more about this? Do you see ADAS as being a useful vehicle for technology transfer?

Tony Pexton: ADAS was extremely useful in that it was unbiased and didn't have a commercial interest in the technology it was transferring. There are companies now which have knowledge transfer systems. I can think of a number. But they a) have a commercial interest in that knowledge and b) I am just wondering, if that commercial interest was compromised, whether they would still put money into the knowledge transfer system.

I can think of at least two things on the arable side—reduced seed rates, for example. It is not really in the breeders' or the dealers' interest for me to cut back on the amount of product that I am using. But there was a lot of research done on reduced seed rates, which was very helpful to the industry. Likewise with control of pests and diseases, particularly in my case a blackgrass, which is closely related to wheat and therefore very difficult to control chemically. But we can help that control by cultivation techniques and using different cultivation techniques.

Again, there is no great commercial advantage in a commercial firm taking up that particular work and transferring it to me. So, an independent body that can help me to understand how better I can farm, even if it is using what might not be commercially attractive technologies, is extremely useful.

Q270 Lord Lewis of Newnham: And no such thing exists at present?

Tony Pexton: I would claim that TAG does, but I would be slightly biased in that. That particular type of non-commercial knowledge transfer is not particularly common. I think that a lot of the movement in agricultural productivity will come from small steps rather than big incremental steps and those small steps may not have a commercial advantage for a commercial company to pick up.

Q271 Baroness Howarth of Breckland: This is very interesting evidence, because the concept that these things are better developed in the private sector than through government grant is often reported. But we did hear from American evidence that where funding was targeted by government, that made the difference in the knowledge transfer.

It seems to me that what you are really saying to us is that independent private developers have their own self-interest, and that's the way that works, but the overall knowledge transfer is going to be difficult in a strategic sense. Is that what you are saying? It is important.

Tony Pexon: Yes, and I have an example from our own farm. In 1966-67, we decided to bring our sheep inside for winter to house them. It was in no-one's commercial interest to help us develop that or to spread the story. In-wintering is now a very common procedure for lambing flocks. ADAS helped us develop that and take some of the wrinkles out of it and had open days and everything else. I can think of no advantage that any commercial firm would have picked up in that. But it has made a significant improvement in our ability to keep sheep.

Lord Lewis of Newnham: In your evidence, which I thank you very much for, you make a point about the democratic structure in the sector. Do you think that this has got any influence? You are implying that there is wide concern over the lack of new blood coming in. With no disrespect, older people are less prone to change. Is there any problem here that you've seen?

Tony Pexon: I think there is often seen to be a problem. Agriculture is amazing. The average age of farmers has been about 58 for 25 years. So we're taking something that none of the rest of the population has access to. On my farm, I know who is running it now. It is my 32 year-old son, but I would still be listed in any statistic as the senior partner.

I think it can be slightly overplayed that people in agriculture are getting older, but at the same time there has not been a lot of incentive for youngsters to come into the industry. Let us be honest about it. It has been low profitability, long hours, working in fairly anti-social conditions sometimes. People have gone to university and seen that, "There is something better I can do with my time".

Now, if you talk to agricultural colleges and training organisations, there is a more vibrant feeling about agriculture, because of the background that we all know about, and youngsters are seeing it as a career prospect—not necessarily straight in agriculture, but in research, for example. Again, we have been concerned about the youngsters going into research. We are hoping to play our part in addressing that and I'll ask Dr Barsby to embellish that. But again, it is because of the general prospects of the industry that we feel that people are getting more interested in what the industry has to offer.

Q272 The Earl of Arran: But profit is not much better?

Tony Pexon: I think it is becoming better.

Q273 The Earl of Arran: For the future?

Tony Pexon: That would be getting into unwelcome detail, but I think the prospects over the next X years are better than they have been over the same number of years looking back.

Q274 The Earl of Arran: Particularly with GM?

Tony Pexon: I think that would be helpful.

Tina Barsby: I think in terms of young people coming into agricultural research, there is a point to be made here. We have had problems since the advent of DNA technology, genomic technology, and genome sequences, where the first advances were made in human

and animal genetics. When you get DNA into a test tube it is exactly the same. So young people come in; they have been trained in these techniques and they can apply that knowledge either in the human, the pharmaceutical or the medical sector, or in agriculture.

They have wanted to do good, to help people and to have a worthwhile career and so they have gone into the medical sector. I am quite optimistic that now that the environment and climate change is high on agriculture's agenda that we will start to see some of those people wanting to have careers in agriculture. But it has been a problem.

If you look at the demographic at NIAB, our institute, we have the same issue. We have too many older people and we need to get new blood in.

Q275 Baroness Sharp of Guildford: Moving from UK research to European research, there are something like €53 billion going into the current seventh framework programme, of which €2 billion are going into agriculture and biotech. What in your view is the usefulness of the research supported by the EU? What might be done to improve its utility? Do you think it is targeted enough, and do you share knowledge of agricultural research work with other institutes across the EU?

Tina Barsby: I will limit my response to the projects of which I am aware under the 7th Framework Programme. I would say: yes, useful; and yes, well-targeted. Because you have a lot of competition and there will be a call for proposals in a particular area, often a lot of work is done beforehand—a collaboration between institutes across the EU—to get ready for a bid. Particularly under the 7th Framework Programme, we are seeing increasingly that the administrative burden is off-putting. A reasonable-sized project involving two or three institutions across the EU would need a full-time administrator to deal with the paperwork.

I am in the process of putting one together at the moment that has a 10-page impact statement, for example. Often it is not the scientists who are well qualified to put those things into place, and the reporting requirements are very onerous.

There is also the need for private institutions to match funding if they are going to be involved, which again can be off-putting. There are also some complications, which I don't fully understand; for example, where there are anomalies between different countries in the EU as to whether industrial partners can join in with projects or not. This is particularly relevant to the UK because of the situation with plant breeding. We have no publicly funded plant breeding in this country since the Plant Breeding Institute was privatised in the mid-1990s. Other countries similarly have moved away from public breeding, but perhaps not quite as much. They have allowed those parts of breeding which previously were in the public sector and now are in the private sector to benefit and to bring their expertise to research projects and, therefore, essentially to receive a payment.

In the UK we cannot do that and I don't fully understand why there is that difference, but it exists. That means that to some extent we are limited in the UK to the sorts of expertise that we can bring to those projects. If a UK-based breeder wants to be involved, they could not be paid to do the job and would only do it if it was in their commercial interest.

Perhaps I am mixing up the EU funding with in-country funding, but there is also a grey area between the two.

Q276 Baroness Sharp of Guildford: You said that on the whole you feel that the usefulness of the projects is fairly considerable. Picking up on the point of technology transfer again, do you feel that with the EU projects there are mechanisms here for technology transfer? Do you get to know what's going on in the EU projects?

Tina Barsby: I think it is a bit like what we have in the UK with BBSRC. There is a difference in my mind between technology transfer and dissemination activity. It's one thing to say, "We're going to have an event or a seminar where we'll tell you what's been going on with this project", so you've done your dissemination and ticked your box, but that doesn't transfer that knowledge on to Tony's farm.

Although there are mechanisms, as Tony described, in the private sector, some which we do ourselves, they are not consistent and targeted. There is no structure. I think that there may be examples in other countries, particularly Australia, which collect that research and say, "Right, we now have the basic research and then we have this activity, which will take some of the risk out of the public sector and take it to the next stage". That is missing.

Q277 The Earl of Dundee: A possible deficiency that you allege is that there may be no consistent method for translating important discoveries in basic plant science into action on the farm. However, does not AHDB set out and claim precisely to provide that link?

Tony Pexon: No, I think the word basic is important here. We are talking about basic plant science. The AHDB is involved in nearer-market knowledge transfer rather than some of the fundamental stuff that Dr Barsby and her colleagues are finding out about—gene technology, for example. Yes, the AHDB has a role in the transfer of knowledge, but it is much nearer market than some of the basic research that we are talking about in this context.

Q278 The Earl of Dundee: You have already mentioned ADAS and how that wise agency was able to support your innovative policy in the 1960s. More recently, we increasingly hear from ADAS that it sets out to give advice to farmers through intermediaries. How effective do you think that model is?

Tony Pexon: Again, I come back, first, to the commercial interest of some of those intermediaries. Whether they are commercial companies or individuals who are advising farmers on their crop protection technologies, a commercial interest is very often tied in there. Secondly, if there are techniques and technologies that might be useful to me but do not have a commercial basis for the person who might give me that information, then I am less likely to get that information.

Q279 The Earl of Dundee: What alternative approaches are you aware of which may be deployed in other EU member states?

Tony Pexon: I am afraid that I cannot give you a blow-by-blow account, but I believe that there are better funded knowledge transfer systems in Ireland, the Netherlands and Denmark. But I would not want to hang my coat on that.

Q280 The Earl of Dundee: I will definitely not press you, but do you think it would repay the effort of study to see what they are doing and whether we might adjust accordingly?

Tony Pexon: Yes. I think state support might come into the discussion here.

Tina Barsby: I know a little bit about the situation in France. I talked about NIAB being privatised. The equivalent of NIAB in France was never privatised. The privatisation of the equivalent of ADAS was pulled back from. There is an example of where some of the things which we have in the private or not-for-profit sector are still government-funded. They are able to have much better and much more consistent coverage than we can achieve with the funding and commercial pressures that we face. Perhaps I may add something about the AHDB in relation to genetics and their timeframe and supplement Tony's point about

looking at things which are near market. If you make a cross in wheat tomorrow that may introduce a new disease resistance, it will take you seven-plus years to get that near to the market. AHDB's involvement in genetic research is quite small, because it takes a long time and the levy payers want quicker results. If you look at what the levy payers appreciate about what the levy boards or the HGCA produce, it is the recommended list of varieties, which is of immediate use to the farmer and his decision-making on farm. Although everyone would say that we should do a small amount of this, it is not a major priority.

Q281 Baroness Howarth of Breckland: I was interested in your answer to Lord Lewis about who should ensure that the public understand about innovation. You thought it might be the Government. In your remarks, you say that, “networks embracing researchers, consumers, producers, retailers, advisers and government are required, and it is vital that retailers are fully engaged, as they provide the final highly trusted conduit for the results of innovation”. That seems a better partnership, because everyone has a place in it. Who else do you think should take the lead role in developing these networks as well as the Government and, as you say, highly trusted retailers?

Tony Pexon: First, I believe that that sort of knowledge transfer and innovation system would be extremely useful in the industry, and indeed it is starting already. One of the major supermarkets is looking at pump-priming funding for what is called a centre of excellence for UK farming. That is looking at the whole chain and introducing innovation but also taking costs out if possible. So it is starting, and commercial interest is driving it—there are no two ways about that. But you have to have people who are trusted in this. You have to be careful. A remark was rightly made earlier about promoting GM. If a scientist does it, there is a touch of “Well, she would say that, wouldn't she?” about the comments. Here again, the retailer has the trust of the consumer, but there is the old argument about whether the consumer drives the retailer or the retailer the consumer—answers, please, on one side of A4. That is a very difficult one, because, at the moment, the retailers will not go anywhere near GM because they say that the consumer does not want it. But could retailers lead an interest in GM? I am convinced that, at the production end of the chain, this sort of co-operation and co-ordination is important. In the next 25 or 30 years, my son will have to learn a lot of the techniques, not just on the production side but on the marketing and acceptability-of-what-he-is-doing side. He will be able to learn that only if he is getting the proper knowledge coming down to him. There has to be a two-way chain: this is what we can do, this is what we want and let us work it out in the middle. I hear anecdotally of certain demands being made by some of the retailers which are almost biologically impossible. So we have to have that two-way communication as to, “What would you like? How can I produce it?”.

Q282 Baroness Howarth of Breckland: One last point. Where do you see the focus of that? Partnerships are amorphous. You have to have some sort of pulling-together so that you have a strategic place that you want to be at. Then you can look at each part and tactically move forward. Where do you see that coming from? I have to declare an interest which is not on your list because I am not involved in it now: I spent seven years with the Food Standards Agency during the whole GM debate, and I recognise the mistakes that were made in educating the public during that period. If that is not going to happen again with innovation, how do you see it being taken forward? Who will be the key in that partnership?

Tony Pexon: I think, again, that the Government would be critical in this, because they are seen as a neutral partner. I say neutral because there is no commercial or scientific interest, or whatever; therefore government might be the glue that holds it together.

Q283 Baroness Howarth of Breckland: But the Government, in the form of the Food Standards Agency, have been saying that GM is fine for the past 10 years. I am suggesting that it has to be more than government.

Tony Pexton: Yes, it has to be more than government. Sorry, I misunderstood your question; I understood you to be asking what the focus would be—the glue holding it all together. I have difficulty in coming up with an answer that says, “This is how it will work and this will solve the problem”. As I said right at the beginning of our evidence, I believe that the background to acceptance of innovation and technology is changing. I believe that commercial interests will also have an influence on what happens and what does not happen. We all have a very sensitive nerve called the hip pocket. A whole range of interests will impinge on that chain.

Tina Barsby: I think that retailers—as much as we said about Governments in the beginning—have to be supported and encouraged to make science-based decisions. They have been under tremendous pressure from certain unscrupulous lobby groups which are not science-based. They have to be encouraged and supported in doing that. I say that government has to take the lead because of competition. If the people who sell you seed are competitive, then the supermarkets are so much more so. To bring them together will require government initiative.

Q284 The Earl of Caithness: I want to come back to Baroness Sharp’s question about EU research. Would you agree that agriculture, because of its structure, is in a less favourable position to get research funds from Europe than, let us say, the health sector?

Tony Pexton: I am not in a position to give a positive answer to that. I shall leave that to Dr Barsby.

Tina Barsby: I would say as well that I do not honestly know. Agriculture is much more fragmented; there are many more small businesses involved. You have to work at the level of representative organisations. The big pharmaceutical companies, for instance, are probably more effective at lobbying because of that.

Baroness Sharp of Guildford: But the research funds and projects are essentially largely driven by the research councils. They bring in companies, but, in this sense, the BBSRC is one of the foremost biological and biotechnology research councils in the EU and we have been disproportionately successful in gaining research funds generally from the EU.

The Chairman: This has been a tremendous session which has taken us in directions we did not quite expect to go. Thank you very much. You gave us some great insights.

Examination of Witness

Witness: **Professor David Leaver**, [Professor Emeritus, Royal Agricultural College].

The Chairman: Professor Leaver, welcome. You are particularly welcome in the light of your November report, which we have all read with interest. It has been extremely useful to us. To deal with the formalities, you have in front of you a list of interests that have been declared by committee members. This is a formal evidence-taking session of the sub-committee. Full shorthand notes will be taken. They will go into the public record in printed form and on the parliamentary website. We will send you a copy of the transcript,

which you will be able to revise for minor errors. The session is on record. It is being webcast live, and it will be available on the parliamentary website. For the record, please state your name and position, and then we can go to the questions.

David Leaver: Thank you, my Lord Chairman. I am Emeritus Professor of the Royal Agricultural College. That results from my time as principal of the college at Cirencester. Before that, I was professor of agriculture at Wye College and Imperial College. Since I retired in 2007, I work with a number of organisations, particularly at improving the competitiveness of agriculture, which I feel quite strongly about, and at the role of R&D in supporting that. Those are my activities now. I should say, in view of the discussion earlier on knowledge transfer, that I am also president of the British Institute of Agricultural Consultants, as well as holding a number of other roles, including working with the Government Chief Scientific Adviser on his food research partnership, and I chair the Royal Agricultural Society of England's practice with science committee, which is particularly concerned with the issues that we have been talking about.

Q285 The Chairman: In paragraph 13 of your very helpful report, you say that "increased agricultural productivity and competitiveness are influenced by a range of factors but science-driven innovation and the development of new technologies and systems are essential elements". Looking at innovation in agriculture, there are really three questions. Do you see this as essentially a top-down process with new technology being developed by researchers and handed down, as it were? Secondly, what about bottom-up processes? How do you see the space they occupy? Thirdly, perhaps you could say a few things on networks. How can things be shared laterally?

David Leaver: The innovation that comes out of basic research is very important to us in this country and to other countries and therefore there is a significant element of innovation that needs developing and taking up, ultimately by the industry. However, I think it is quite important to understand that innovation happens at all levels, between basic research and practice and also on farms. Much of my career was spent in applied research in agriculture, and many of the ideas that I tested were innovations coming from farms. So it works in both directions, although the things that we tend to talk about and hear about most of the time are the ones that arise from basic research.

Q286 The Earl of Dundee: It very good to have your reassurance that it works in both directions, but on the bottom-up direction, what mechanisms are there at the moment for encouraging that? I am not sure if there are any. Would you like to comment? If you look at how it happens at the moment, how can it better happen? Is knowledge from the bottom up better disseminated ad hoc or by encouraging institutions to do it?

David Leaver: It might be worth saying that when we think of the research pipeline—the connection between basic research and practice—we have innovation all along, and we have information flowing in both directions. It is sometimes useful to think of this as being at one end a research push, which is coming from the basic research end, and, at the other end, a research pull from the industry. However, accepting the point that you have raised, innovation which is taking place within the agricultural industry often needs some applied research to clarify whether it is just a red herring or whether it is worth taking up.

My concern is that over the past 20 years or so we have lost the research push because at the research end of the pipeline, nobody is pushing, unlike in medical research, where we have applied research going on in the public sector connecting to pharmaceutical companies and to the large charities that are funding that type of research. In agriculture, we do not

have that. We have this gap in the middle where applied research could at one end be taking innovations from basic science, but could also be looking at innovations on farms and the way that things are developing. That loss of applied research in between is, as much as anything, why the research pipelines have fallen apart in many areas.

However, we have to be careful in talking about research pipelines as not all are the same. If you take a vaccine for use in farm animals, we have still got the research pipeline in place, and, to some extent, it is still there in the animal genetics and plant breeding areas that you were speaking about earlier, although there are still some problems. However, in other research pipeline areas, the links have disappeared altogether, so we have to be careful about generalisations.

Q287 Lord Cameron of Dillington: How central is biotechnology and genetic modification to our progress in European agriculture? Do you think there is a possibility that the heat being generated by this whole debate is taking our eye off other possible advances that could be made?

David Leaver: I think biotechnology is extremely important to the future, but there is a danger in thinking that all biotechnology is GM. There is a lot of biotechnology going on and being taken up and utilised at the moment. Genetic markers are a very good example of how in animals and plants we are seeing biotechnology methods applied. In genetic modification, which is the difficult area, you only have to see the growth of GM crops globally to understand its importance. The problem is that because there is such a blockage to progress in Europe, no one is going to innovate. We were talking about wheat earlier, which is very important to Europe, probably much more so than to the United States and to other continents, but no one is going to do the useful GM developments with wheat until there is a change of view. At the moment, we have to continue to use biotechnology in the areas in which we are allowed to use and develop it, but it remains to be seen when GM, as we know it in other countries, is going to be taken up in Europe. So not only do we have to deal with that issue in the UK, we have to deal with it in Europe as well.

Q288 Lord Cameron of Dillington: How are we going to get this across to the public? Should there be a big push on distinguishing between cisgenic modulation as opposed to transgenic modulation so that the public understand that a lot of it is about silencing certain genes rather than necessarily—

David Leaver: I would guess that looking at that level of detail will have no impact at all on the general public. As Tony Pexton said, I think attitudes in the UK are changing, and people see the need for greater production, but the expression that came out in the Royal Society report—sustainable intensification—is important. We have to look at sustainability in its widest sense, as well as to GM. The aspects of sustainability in GM that has not been sorted out yet is the social aspect, the things that you were talking about. I do not think there are any concerns about the eating implications of GM. There are some in terms of the environmental implications, which must be addressed, and I think we all believe that they should be addressed, but there is no reason to hold it up in principle. We should be looking at individual innovations and developing them.

Q289 The Earl of Arran: You have already very ably and interestingly answered a question about the weakening of innovation in new technology over the past 25 years or so. In your view, does this country still have some strength that could point the way for others in Europe in applied research capacity?

David Leaver: It is difficult to say in applied research capacity because we have lost so much of it. Since this has been going on for some time, most of those who are left in research are people from the basic research end of the pipeline. Although we say we spend £280 million a year on agricultural research in this country, very little of that gets invested by the public sector in improving the efficiency of agricultural production. Most of it goes into basic research, which is not particularly directed at increasing productivity, or into other areas in support of Government policy.

I can only go off what I hear from many people from the rest of Europe, who say that they no longer come to the UK to look at what is going on in agricultural applied research. They will go to Ireland in preference to here on the livestock side or will go to other organisations in Europe where they have retained a certain amount of applied research. We are not the only people to have reduced our applied research effort, but we have done it much more drastically, and we now have a system that is a basic research system with very little organised funding for applied research, which is why we do not have young people doing PhDs in agricultural research in the applied science area.

The Earl of Arran: Time and again, from all the witnesses who have come before us, we have heard the same thing: this fundamental lack of research and funding for research in this country is critical. It is coming home. It is really almost the strongest point that is coming out.

David Leaver: Yes. I would be the first to defend our basic research. I think it is extremely important and of high quality. I saw a wonderful slide not long ago which showed that we are level with the US in terms of how the quality of our basic research is valued, but I saw another slide which showed where we are in terms of growth in productivity—growth in the efficiency of production in our agriculture—and we are towards the bottom of the league. How can we be top of the league in basic research, but getting towards the bottom of the league, or in the second division, of applied research? There is something wrong.

Q290 Lord Lewis of Newnham: In your extremely interesting report—thank you very much indeed for it—you mention that there has been a large decrease in the number of agricultural colleges and institutions of that form. Do you think that has any bearing on this problem? I am slightly concerned. I declare that I am a pure scientist, but at many institutes I go to, such as Rothamstead and John Innes, I talk to people who, in my mind, are pure scientists. They are working on a problem that has an applied aspect, but they are basically physicists, botanists, chemists or something of that nature. They are not people who came through the old agricultural colleges as I remember them, which had a much more direct interest in the agricultural world as a whole. How far is this a factor?

David Leaver: It is part of the same story. Inevitably, if funding goes down for certain areas, you get closures. Colleges either close or change their direction because they have not got enough students who want to come to study there. I think probably in the early 1990s, when the industry was facing quite a lot of problems, we got a downturn in the number of students applying to agricultural colleges and for university places. I think that demand is increasing now, but a lot of those university departments have already closed or have changed their emphasis, as have many of the colleges. We know that two important colleges closed—Wye and Seale-Hayne—which has not helped. On the research funding side, it is also a reflection of the way that government funding has shifted away from applied research in agriculture. However, I would re-emphasise that not all areas of funding for applied research have been withdrawn by government. It has in agriculture and agriculture does not have alternative sources of research funding.

Q291 The Earl of Caithness: I should declare an added interest for you in that I am an MRAC. You make 20 recommendations in your report. What are the three most important ones? How would you implement them? What is the cost, and would you change the roles of the Government, its agencies, funding bodies and the private sector?

David Leaver: I'd have to study and think about my 20 recommendations to pick out the first three, but the ones that immediately come to mind are: we have to have a significant change of view by the Government in funding applied research in agriculture. I don't think they should be supporting the research very close to the farmer, but at the moment basic research is not encouraged to look in that direction. It is looking deeper rather than at where it can be applied. Secondly we need a shift in funding from basic to applied research. In summary we need a change of thinking and a shift of funding from basic to applied research. That can be done most quickly in the research institutes that still remain involved in agriculture. It needs to be recognised that there is a reward to scientists for being involved in working together along the research pipeline. If you have the research push at one end and the research pull at the other, there has to be overlap, and I think that it is that overlap that is so important. As I mentioned earlier, it will differ for different types of research as to where the overlap has to occur. However, it is mainly a change of understanding and attitude that has to happen but, significantly, also a change of funding. I should also add that an important part is that we have to get acceptance that sustainable intensification, to use the Royal Society's phrase, is where we need to go with agriculture. We need to have research funded—I suggested under a list of themes—which means that, whether it is at a very basic level or more applied, it is looking towards the problem and the issue that we are going to address, because that doesn't happen at present. Sorry, what was your third point?

Q292 The Earl of Caithness: Should there be a change in the role between government, its agencies, funding bodies and the private sector in order to make sure that the system works?

David Leaver: It is rather a generalisation, I realise, but it is so important that in the future the public and private sectors work together to identify where these gaps are in the research pipeline and, between them, make sure that they are filled. That is going to be the answer to most of the things that we do. This is a BBSRC point, but we undoubtedly lost out as an industry when the Agricultural and Food Research Council was absorbed into the BBSRC. As with the Medical Research Council, the research funded by the AFRC, no matter what level it was at, was ultimately for the benefit of the agricultural and food industries. We have lost some focus because of that and I do not know how the BBSRC is going to reintroduce that focus. I realise that some initiatives are taking place, because I am involved in some of them, but that agricultural focus on where biological research should be partly aiming has been lost.

Q293 The Earl of Caithness: Can I ask a rather more general question? I don't know whether you are going to know the answer to this. It was said that 10 years ago, at the beginning of the 21st century, we had to double agricultural food production by 2030. Do you have a health check on that? We are a third of the way into that timescale. What has happened to agricultural food production world wide?

David Leaver: There is some very good FAO information on this in terms of how demand and production are increasing. The problem is that production varies considerably between years, for all the reasons that we know about, and there is some uncertainty over the future because of climate change. In spite of the UK and northern European being well fitted to

handle that increase due to our climate and soils, a lot of the increase in production that is going to take place will come from outside Europe. At the moment, lots of the increases are coming through the emerging economies of the world. In terms of a health check, I think it is probably, on average, going satisfactorily, but the problem is that food shortages only occur in certain countries. It is the case that 20% of the world's population is currently undernourished. Those are the big issues and the UK certainly can't sort that out itself by increasing its production. However we should remember that our own population is going to increase by 20%, and our food self sufficiency has gone down from over 70% to below 60% over the past 15 years. That is why I'm interested in the competitiveness of agriculture, because only by being competitive will we stop this increase in reliance on imported food. In fact, that is ultimately the issue that Europe will face. If it starts falling behind the rest of the world in efficiency of food production because of its view on GM and so on, Europe could well face the same problems in a few years' time.

Q294 Baroness Howarth of Breckland: I am interested in this issue of competitiveness, private intervention as against public grants, and how you direct funding, as you heard from my previous intervention. I wondered how you think that productivity is going to continue to be sustained, if you say we are on track now, by the balance between the private and public sectors. What do you think the particular pointers are to get that balance right?

David Leaver: My point was that it is about managing supply and demand globally, not just that we are relying more on imported food over time in this country. My worry is for Europe. Does your point about the public and private sectors relate to the UK?

Q295 Baroness Howarth of Breckland: It is claimed that public sector interventions sometimes interfere with the development of competitiveness. We have heard that. We have also heard that good and well directed public sector funding—I think that is the point that you were making about grants—actually improves the interconnectivity between innovation and productivity. The key question is: how do we make all those things hold together in order to move forward? I wondered what your view was on that.

David Leaver: Essentially I agree with you, because I feel quite strongly about the need for the public and private sectors working together and that is happening to some extent. The BBSRC has been working with the other research councils and with government and other bodies on the global food security research programme. As I have said, my concerns relate to the fact that it will be focused on basic research and not on supplying the full breadth of research. As regards the public and private sectors working together in other ways, I think it should be ongoing and not just a one-off event to set up a research programme.

Q296 Baroness Parminter: You have been very clear in your report and to us today about what you want to see happening for funding for basic and applied research. I would like to tease out a bit more how you translate that research and ask you some questions about the extension process that we have at the moment in the UK, your views on that, whether extension services might be improved in future and what might be the role of the AHDB. As a supplementary to that, in your experience, are there conditions that make some farmers and businesses more susceptible to accepting changes in technology and innovation and, if so, what are they and how can we overcome those barriers?

David Leaver: As we discussed earlier, we are in the position we are in. ADAS was privatised, and I have to declare an interest as president of the British Institute of Agriculture Consultants. Those consultancy businesses will only develop if there is the pull from farmers

wanting to pay them for advice in an independent way on how to move forward. I don't see that as a problem. It is up to the agriculture industry to sort out knowledge-transfer at the applied end. Other industries do not have public sector support; for application of knowledge so why should the agricultural industry? If farmers want knowledge, they should be looking for it and, if necessary, be prepared to pay for it.

In terms of how receptive individual farmers are to advice, clearly, we have a bigger range in productivity compared to most industries between the most efficient farmers and the least efficient farmers in most sectors. It probably varies more in the livestock sector than the crop sector. Clearly, some farmers don't want to change. They farm more for the lifestyle and are not too susceptible to change unless they are absolutely forced to, whereas others are very innovative themselves, and are really pushing the research side to come up with ideas. I think that's inevitable and I don't think agriculture is or should be any different from any other industry.

Q297 Lord Lewis of Newnham: In your article you talk about the development of new metrics for the sustainable intensification, if you like, of agricultural production. How are you going to set long-term targets for outputs in R&D investment and, in terms of sustainability, productive gains in each sector? Can you say a little bit more about the metrics side of that? I am with you all the way: ideally, you want to measure something in order to be able to compare what is happening. Who should be responsible for the determination of those metrics and how would innovation be factored into the metrics?

David Leaver: We can think about metrics at different levels: national, regional, local and even individual farm level. We may need different metrics for each. At national level, Defra already produces quite a lot of statistics. The reason for having the comments on metrics in the report is that, as much as we might dislike the term sustainability, it has important uses. We have to look at the economic, environmental and social aspects of what we are doing, and we should have metrics across all three areas.

In the national metrics, at the moment, we have those on agricultural output, on productivity, on environmental and social aspects but they are not joined up in thinking about sustainable production for the future. At national level, we need some bringing together and development of new metrics for what we want, because, the Government has to make the decision on which areas of sustainability it is going to support and which it is not. The difficulty is that there are trade-offs. If you push at one indicator of sustainability, the odds are that you are going to knock down another one, and we do need to understand those interactions.

At more regional, local and farmer level, we may want to use different metrics that impinge more directly on our business. We can have national yield metrics that indicate that to keep pace with the growth in demand for food, we need, say, wheat production to increase by 2% a year. That is something that we can check and ask the question—why is it only growing at only 0.5% per year? Therefore, we need to understand those metrics better, but there are other metrics that we can use at farm level that look at the sustainable intensification aspect, such as yield per hundred kilograms of nitrogen fertiliser, energy input, labour input or whatever is critical to future development. We need to look at critical metrics that reflect the sustainability issues that we have to reflect on in future within this overall aim of sustainable intensification. That is really what I was trying to get at: to try to bring these together while remembering that you need different metrics for different levels.

Q298 The Earl of Arran: This is not to do with this particular inquiry, but you have had huge experience in the higher echelons of agriculture in this country. Do you still think that there is a good, profitable future for youth in agriculture?

David Leaver: Absolutely. I don't think I would be involved in agricultural education if I didn't think that. I left university in 1964 and I remember being told then that the average age of farmers was 58, so I'm slightly suspicious about why that is again being said. We need young people to come into the industry. One can innovate at all ages, but we need young blood. Defra produced some figures that show that only 12% of farmers have spent a three year period in full-time education in agriculture. I fully accept that somebody who has had no education can be quite innovative—we hear that argument quite often—but if you bring in an educated group of young people, you will have a higher proportion who are innovative. I think it is very important to move forward in our competitiveness, and I have great confidence in the future of the industry. We are at a turning point now and we need to get ourselves organised to make sure that we take it forward. That is why I was very happy to write this report and respond to you.

Q299 Lord Cameron of Dillington: My question is a technical one. You said that the UK Government has retreated from applied research in agriculture, but not in other fields. In what fields has it not retreated from applied research?

David Leaver: The obvious one is the medical area. We hear on the radio every morning of a new potential—

Q300 Lord Cameron of Dillington: But that is largely done through big companies, isn't it?

David Leaver: Absolutely. As I said earlier, it is really about, at that early stage, getting the basic research moving in the right direction to potential applications. Then, companies, or the Wellcome Foundation—

Q301 Lord Cameron of Dillington: Yes, but I was talking about the Government as such, because the Government does not involve itself all that much in that in the health sector, apart from the checking and the monitoring.

David Leaver: They fund the Medical Research Council, which runs a lot of that early applied research. We do not have the Wellcome Foundation and similar bodies to fund us, and the pharmaceutical industry is only involved in a very small proportion of agriculture, in the livestock sector, so we don't have the infrastructure there. We have to increase yields but with the complex interactions with soils, biodiversity, nutrient pollution and with a range of other technical issues and, it is much more challenging. Therefore, I would argue that, proportionally, the Government should be putting more funding into applied research, through its agencies, if it wants us to have a competitive agriculture.

Q302 The Chairman: Thank you very much. It has been a most stimulating session. That is a good note to finish on.

Scottish Agricultural College (SAC)

Written evidence (IEUA 19)

Introduction

SAC (Scottish Agricultural College) welcomes the opportunity to contribute to the House of Lords European Union Committee (Agriculture, Fisheries and Environment Sub-Committee) Inquiry into how innovation in EU agriculture can be encouraged in the context of new challenges such as climate change, water scarcity and the need to encourage sustainable improvements in output.

SAC is an innovative, knowledge-based organisation that supports the rural sector through research, education and expert consultancy services. SAC wishes to see, and contribute significantly to delivering, a sustainable agricultural and rural land use sector in Scotland. SAC staff work in a broad range of areas (for more information see www.sac.ac.uk) and our responses to the questions below reflect this broad expertise, but draw on specific research projects where appropriate.

Several SAC staff have contributed to this submission which has been co-ordinated by SAC's Rural Policy Centre (www.sac.ac.uk/ruralpolicycentre/).

Executive Summary

- We agree with the three-stage description of innovation as set out by the Committee and that innovation should be proactively encouraged as it is critical to growth in the agricultural sector. Agriculture is a dynamic industry with a history of innovation and adaption to change, but arguably the industry is currently facing challenges which are more significant than those in the past (e.g. climate change and an ageing demographic).
- The 'continuum of understanding' can be used as a tool for understanding the conditions under which agriculture is best placed to innovate. Human and financial capital, and the freedom to deploy them, are critical. SAC is involved in all stages of innovation development from conception through to implementation. The organisation is uniquely placed to offer the multi-functional and inter-disciplinary capabilities to convert research advances into industry uptake.
- There are many barriers to innovation, including those relating to human capital (e.g. low levels of buy-in, the cognitive abilities of potential innovators, the demographic distribution of farmers and a lack of clear succession plans for farms). Other barriers include: public perceptions of farming in which innovations are often seen as 'hidden dangers'; poor returns to agricultural activity which reduce the ability of a business to invest and the risks that businesses are willing to take; difficulties in demonstrating the costs and benefits of innovations; and the lack of recognition and reward for scientists to engage in knowledge exchange (KE) activities with end users.
- We do not feel that it is appropriate to try and estimate how much the ageing demography of farmers is an obstacle to innovation in general as this will depend on the innovation and its context. Bringing new recruits into the industry would not, we believe, increase innovation in the short-term - this would only happen over time as they moved into an age/education bracket when understanding and contextual experience are optimal for innovation. Increasing innovation as a stimulus to bring in new people may have

potential where lack of innovation is a key barrier to entry, but overall it is more likely that resources (particularly financial) are a more important barrier to entry.

- There are four key challenges driving innovation in future across the EU: country variation, cross-border challenges non-specific to agriculture, market failure and low farm income levels. Responsibility for driving forward innovation should be shared across all actors in the sector, according to who has power, opportunity and resources.
- We agree that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government, but it should not be seen as a linear process. Also, the evidence suggests that farmers will learn from different sources thus no one method of KE will suffice. Moreover, programmes that encourage scientists to take on board practical messages are required.
- It is widely acknowledged that there is a shortage of specialists in weed and soil science, agronomy and 'whole system approaches'. Many specialist agriculture courses in the UK have shrunk or disappeared meaning a lack of graduates with relevant data, information and knowledge.
- It is critical that future research priorities are identified from the 'bottom-up' as well as the 'top-down'. Often farmers and farm advisers are better placed to identify real knowledge gaps than scientists. KE based discussions should be used to collaboratively establish the research agenda for agriculture. 'Who pays' should relate to who benefits and the type of good/service. Participatory research approaches and farmer-to-farmer exchange should not be under-estimated. SAC has much experience in KE in the agricultural sector.

Definition of “innovation” in the agricultural context

1. We have outlined above how we currently perceive “innovation” in the agricultural context, but we would welcome views on your interpretation of innovation in the agricultural sector.

We agree with the description of 'innovation' set out by the Committee and the three stages of innovation: conception, development and the adoption (or 'deployment') of innovation.

Various trends have favoured innovation in rural areas recently, both within and outside the agricultural industry. These include: continual technological advancements in food production (GM, disease prevention and management, improved crop/livestock production systems, yields and supply chains etc); the diversification of traditional agricultural enterprises; and new uses of land for energy crops and renewable energy generation, for climate change mitigation and adaptation, and for the provision of a range of public goods.

In future, there are some real challenges to which agriculture will need to respond in innovative ways in order to ensure that they are turned into opportunities. These include: the need to feed a growing population using a limited area of land on which there are multiple demands, meaning that the need to drive up production per unit is very apparent; the possible removal of subsidies, meaning that farmers (and other rural actors) will have to be innovative in responding to alternative schemes (such as rural development plans) in order to access help for new initiatives; the growing cost and limited supply of fertiliser requiring the breeding of crops that can scavenge nutrients and which are less reliant on bagged fertiliser; and climate change, which is acting as a driver to produce more from less land and to develop tolerant and adapted crops.

Innovation in agriculture as a strategic objective

- 2. The EU believes that innovation and knowledge are key to the EU's economic growth and that all sectors should play their part. Do you agree that innovation in EU agriculture should therefore be pro-actively encouraged? Alternatively, do you see agriculture as a distinct sector faced with particular challenges to which the sector will inevitably react in an innovative manner?**

We agree that innovation should be proactively encouraged as it is critical to growth in the agricultural sector. Despite facing a number of challenges (including those related to factors outwith the control of individual enterprises such as the weather and topography as well as the relatively small size yet diverse nature of businesses involved), agriculture is a dynamic industry and has a history of innovation and adapting to change including in relation to markets, technology, production processes and new crops. This has fostered a culture of openness to development and innovation, although uptake is sometimes slow (for example, in the recent cases of precision farming and alternative reduced tillage methods) and led by just a few innovators.

The challenges faced by the sector today are arguably much greater than in the past with increasing globalisation of markets, issues that cross international boundaries (such as climate change), and with respect to the speed with which change often occurs or is required. Furthermore, while historically agriculture has been innovative, we feel that the industry today is facing particular challenges that necessitate on-going proactive support for innovation. For example the ageing demographic and poor succession structures that currently exist may constrain innovation more than in the past. Addressing these industry level challenges is beyond the individual business manager. Innovation thus should be proactively supported and strengthened both by national governments and the EU.

Innovation today

- 3. How is EU agriculture innovating now? Can you explain under what conditions the agricultural sector is best placed to innovate? Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?**

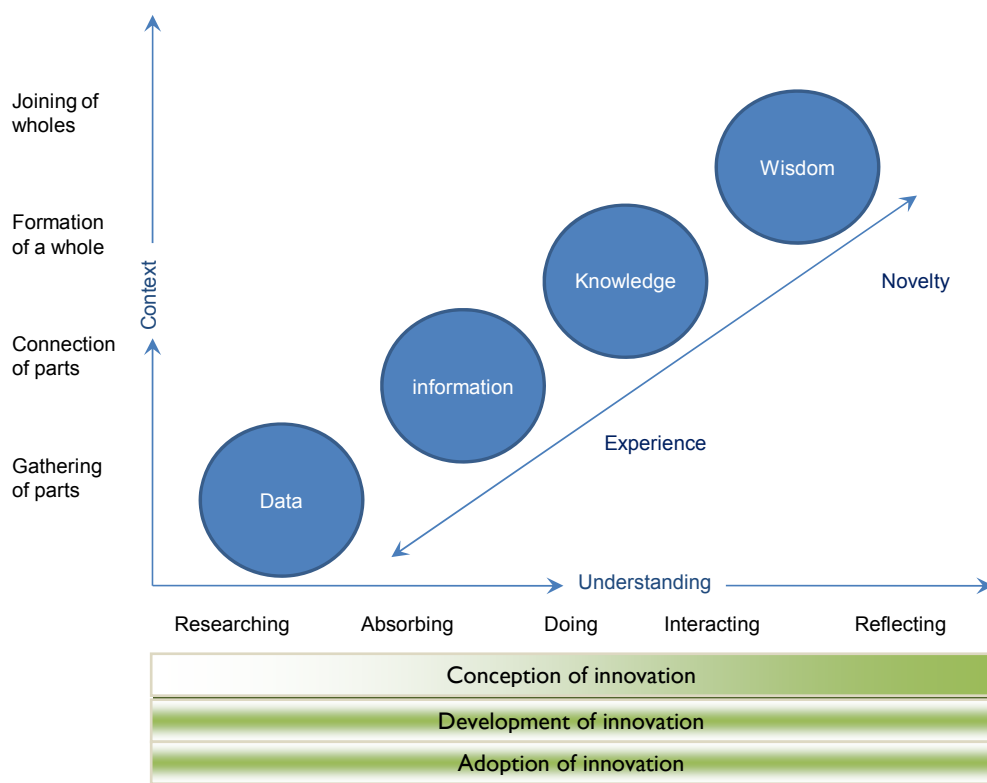
Evidence of innovation occurring:

EU agriculture is innovating in many ways today. Scientists, natural and social, as well as other stakeholders are identifying new solutions to existing problems as well as identifying new problems that require solutions. For example, sequencing of genomes is a scientific development from which innovations in plant and animal breeding are developing. By contrast a deeper scientific understanding of climate is highlighting the potential impact human activity may have and driving innovative thinking and development on how this impact might be reduced. New work is being undertaken in the area of crops, including adapting crops to climatic change and to changes in inputs, breeding for reduced energy use and increased efficiency and breeding crops for marginal land in order to increase production. Farmers are being required to adopt new technologies and machinery (such as GPS).

Producers, processors, distributors, retailers and marketers are having to respond in innovative ways to changing consumer lifestyles, tastes, preferences, ethical values and purchasing patterns with new and modified products, different distribution and transportation methods and new kinds of retail outlets (such as increasing direct marketing through farmers markets).

The conditions under which agriculture is best placed to innovate

We use 'The continuum of understanding' (see below) to structure the subsequent comments on the conditions under which agriculture is best placed to innovate.



Adapted from: Clark, D. (2004)

<http://www.nwlink.com/~donclark/performance/understanding.html> Accessed 20/08/2010

New innovations are conceived within the minds of novel (reflecting) thinkers – those who have understanding and contextual experience. Development of innovation may draw on any and multiple levels of understanding and contextual experience depending on the needs associated with the innovation. Similarly, adoption of innovation will depend on the learning and thinking style of the decision maker.

The conditions under which the agricultural sector will be best placed to innovate are those in which there are sufficient resources for this activity – including human and financial capital – and freedom to deploy them. With respect to human capital, it is particularly important to note the requirement for experienced individuals to start the process. The application of the precautionary principal when applied and commuted to regulations can for example restrict the freedom of innovators to use resources to explore ideas and develop innovations.

SAC involvement in agricultural innovation

Using our own organisation as an example, SAC is involved in all stages of innovation development, from conception through to implementation. Commercial agricultural sectors and funders (at Scottish, UK or EU levels) are integrated in this process. Their commitment to innovation is evidenced by:

- The establishment of capital resources for research at SAC (e.g. Beef Research Centre, Hill and Mountain Research Centre, Dairy Research Centre, ruminant metabolism resource, computer tomography suite, pig and sheep research facilities).
- Support of a critical mass of research scientists generating innovation with dissemination facilitated by integration with the other SAC functions of consultancy and education.
 - In particular, SAC combines expertise from livestock systems research with (1) socio-economics to identify optimum management choices given predetermined constraints (e.g. environmental impact, net margin), and (2) environmental scientists to identify impacts of innovations on biodiversity, optimum GHG abatement options from UK agriculture (e.g. producing Marginal Abatement Cost Curves) and in providing inventories of GHG emissions from sectors of Scottish agriculture to identify where maximum benefits from innovation can be achieved.
- Partnership with industry is integral to most of the research and development conducted at SAC and is further evidence of a commitment to develop and implement innovations. Examples with industrial input at Scottish, UK, EU or global level are given below. Many of these examples include academic collaboration within and beyond the EU. Several activities have resulted in commercial spin-outs (e.g. Tenderscot (SAC and Quality Meat Scotland (QMS)), eCow Ltd and ETS Ltd).
 - Edinburgh Genetic Evaluation Services where genetic evaluations for UK dairy and several major beef and all sheep breeds are performed.
 - Design of breeding programmes for more sustainable use of genetic resources.
 - Optimised breeding programme design, including facilitating integration of genomic selection methods which are expected to revolutionise animal breeding in the future.
 - Demonstrating benefits of breeding for robustness traits and integrating these into existing selection indexes (e.g. ewe longevity and lamb survival; resistance to foot rot and scrapie in sheep; resistance to mastitis and lameness and improved fertility in dairy cattle; calving ease and other maternal traits in beef cattle; piglet survival and reduced aggression in pigs).
 - Assessing feasibility and merits of breeding for improved environmental impact of ruminants (residual feed intake and methane emissions in beef cattle; environmental costs/benefits of high-input, high-output high genetic merit dairy systems).
 - Development of efficient and accurate ways to measure important traits in livestock to aid their improvement (e.g. environmental impact by automated methane capture; behavioural traits including feed intake measurement in grazing animals; carcass traits by visual image analysis of live animals, computer tomography of live animals and primal cuts and development and validation of semi-automatic equipment for routine commercial assessment of meat quality in abattoirs).
 - Development of management practices with multiple benefits (e.g. redesigning farrowing crates for sows; avoiding pre-natal stress affects on offspring development; production of healthy, viable offspring through improved nutritional

- management of early development, modifying upland and hill systems to mitigate GHG emissions and improve biodiversity).
- o Assessing benefits of new technologies as management aides (e.g. electronic identification, motion sensors, directional virtual electric fences).
 - o Reducing wastage throughout the food chain (e.g. improving prenatal and neonatal survival, developing management systems in which animals can meet their genetic potential, defining criteria for optimum live animal transport) and maximising product quality.
 - o Building sensitive welfare assessment approaches into UK and international farm assurance schemes and inspections (e.g. QMS) supporting welfare-orientated marketing and traditional stockmanship skills.
 - o SAC is part of a consortium undertaking the world-leading IMEQ (Integrated Measurement of Eating Quality) project that is a major part of QMS's mission to maintain Scotland's reputation for quality meat production. It will involve integrating various technologies so that they can work on a commercial abattoir production line. The trials will explore semi-automatic and automatic means of measuring pH, temperature, meat colour, carcass fat, eating and nutritional qualities. They will provide valuable data for producers and processors.
 - o SAC plays an important co-ordination role in the Care Farming Scotland initiative that provides opportunities for those suffering from a range of health problems to spend time working the land as a means of promoting mental and physical health.
 - o SAC plays an important role in disseminating information to land managers about new regulations through daily activities and through dedicated knowledge exchange (KE) events.

Examples of circumstances where innovation would have been possible and would have been helpful, but has not (yet) occurred

- New animal medicines – the cost of bringing new products to the market is very high due to compliance with regulations and where the potential market is small, these can be difficult to justify. The effort put into identifying potential new medicines and their development is thus limited. A specific example is ectoparasite control in sheep. Many existing medicines have potentially undesirable side effects and it is known that their efficacy is falling, or is likely to, due to the development of drug resistance. In addition the market for these products in Europe is relatively small, and so the potential reward for developing a new product. Thus, while innovation in this area is arguably highly desirable, the rate of innovation in this area is lower than it could be.
- GM technology – while the ethical and scientific debates continue about the benefits that this technology could bring development of the technology is limited by regulations.
- Widespread use of genomic selection has not yet been realised, due in part to the costs of genotyping. These costs are anticipated to fall and the accuracy of the approach to increase, leading to wider uptake. It is estimated that considerable gains over and above those achievable through conventional genetic selection can be realised through the use of this technology if the correct structure of the livestock industries is in place to capture the benefits from its use. This includes co-ordinated data collation in particular for traits that are hard or expensive to measure such as disease and meat quality.
- Selection for non-production traits such as those that impact on the health, fertility and ultimately welfare of livestock has not yet occurred in all livestock species to a significant extent, with the exception of the dairy industry. This is due to several reasons that

include lack of awareness of the benefits from the use of broader breeding programmes, and an anticipated compromise in the expected rates of genetic gain in the conventional production traits.

- Cloning – again whilst the benefits of cloning are as yet unproven the recent concerns about the market entry of beef from a second generation cloned animal and conflicting regulations between the UK (FSA) and EU have brought into sharp focus the innovative farmers that we have and the problems that can arise in the development and adoption of innovation.
- Currently, low uptake of recording and use of estimated breeding values (EBVs) hinders the considerable benefits that can be accrued from the use of high genetic merit animals in the UK. Recent work published in 2007⁸ showed that the financial benefits of genetic change in farmed livestock are substantial. Over 20 years, the benefits from 10 years of genetic progress at recently achieved rates in recorded sheep, was estimated to be between £5.3 and £11.5 million. If dissemination of genetic material is such that these rates of change are also realised across the entire ram breeding industry, the combined benefits would be £110.8 million. For beef cattle, benefits from genetic progress for growth and carcass characters in dual-purpose beef breeds were predicted to be worth up to £18.2 million. When benefits of genetic improvement were expressed on an annual present value basis and compared with lagged annual investment costs to achieve it, the internal rate of return (IRR) on the combined investment in the genetic improvement of sheep and beef cattle was 32%. SAC has on-going work demonstrating the economic benefits to be gained from selecting on traits such as ewe longevity and lamb survival.

Obstacles to innovation

4. What are the current obstacles to innovation? Is there a shortfall in research capacity and technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their business?

There are many obstacles to innovation and generically these can be classified in accordance with the continuum of understanding by availability of resources and freedom to deploy them. These include, as noted above, lack of human and financial capital and the presence of regulations. Further comments can be made about human capital:

- First, it is important to note that the rate of innovation may be affected by the perceived value of the innovation (as suggested in point 3 in the case of new animal medicine). This is particularly important at the conception and adoption stages. In the absence of a perceived value (or 'need') the conception rate for innovation is likely to be reduced as fewer individuals will focus their thinking on what might be developed. At the adoption stage the level of 'buy-in' will be greater if the innovators perceive that it will be beneficial.
- Second, the rate of innovation will be affected by the cognitive ability (ability to process information and apply knowledge) of potential innovators. Thus if skills in information processing and knowledge application are not developed fully,

⁸ P. R. Amer, G. J. Nieuwhof, G. E. Pollott, T. Roughsedge, J. Conington and G. Simm 2007. Industry benefits from recent genetic progress in sheep and beef populations. *Animal* 01:10 1414-1426.

opportunities are missed. In recent times there has been a loss in some areas of education relating to agriculture. For example, an agricultural science degree is no longer offered by the three ancient universities in Scotland (Aberdeen, Edinburgh and Glasgow) that once were the primary providers of higher education in Agriculture.

- Third, accessibility and level of knowledge is important to innovation. This links to the point above about education and also to issues of demographics that will be noted later. As highlighted in the 'Continuum of understanding' the wisdom from which innovation can come is based on knowledge. Thus contextualised education (i.e. agricultural education rather than just core science education) is vital – but in parts of the UK it is in decline. Furthermore, agricultural development throughout the world has at various times been supported through subsidised extension services – i.e. the subsidised communication of knowledge. These services not only provide knowledge but structure it in ways that ensure successful use of that knowledge, e.g. prioritising the essential lessons over the nuances. The lack of extension services are not in themselves an obstacle to innovation, but poorly structured learning that results in partial knowledge, particularly when essential lessons are missed, can lead to unsuccessful implementation of innovations and hinder adoption due to a developed misperception that it is not beneficial.
- Fourth, the demographic distribution of farmers is skewed to the right (older age). This may be an obstacle to innovation as innovation has been shown to peak in the late 30's and early 40's. Adding to this some recent work has considered the potential trade-off between education (on which innovation is based) and age⁹ highlighting that peak age may vary.
- Fifth, the lack of clear succession plans for many farms indicates that the demographic skew may increase and with it the age obstacle for innovation may increase. Moreover, mature businesses – those which are well established – need to innovate to maintain competitiveness. However, if the business is expected to discontinue in the future this is not necessary so the ageing structure and lack of successors combined pose an even greater obstacle to innovation than when considered alone. This risk is arguably heightened further still in the case of tenanted farms.

A different issue is public perceptions of agriculture in which innovations are often seen as having 'hidden dangers', with a perception that older methods of production are somehow more 'wholesome'. The stand against GM, objections to intensive farming practices and objections to the use of poly tunnels are all examples. Programmes that involve the public and raise awareness of the benefits of some of these methods (perhaps in terms of food affordability, reduced carbon footprint per tonne or the safety record of modern pesticides) would be beneficial in reducing the braking effect that public perception can have.

With respect to other resources, poor returns to agricultural activity are a particular problem for innovation. Poor returns reduce the ability of businesses to invest and the risks that businesses are willing to take with innovations (where there is little evidence on which to make decisions) and it is one of the main reasons limiting the number of young people entering the sector.

It is uncertain what the level of research capacity and technology transfer *should* be. This question can only be answered if a target level of innovation has been identified and the contribution that research capacity and technology transfer is expected to make to it

⁹ Jones, B. F. (2010). Age and Great Invention, *The review of economics and statistics*, 92, 1-14

estimated. As with resources in general, where there is a positive input-output relationship, more in would give more out. What is certain is that more innovation is possible if it was better resourced.

The above applies also to *'what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector'*. Undoubtedly these obstacles exist and block innovation to a degree. We think it is important to recognise their existence and that their relative importance will vary according to the 'innovation' in question – and not necessarily as defined by a normal distribution function. Some case studies have examined the role of such obstacles e.g. case studies in extension activities or uptake of new support schemes and whilst these can provide estimates of effects for those specific innovations in the past, the extent to which they can be extrapolated quantitatively for future situations is questionable.

The area of animal health might make a good case study of how innovation operates in practice and the barriers that farmers face in innovating. The Animal Health and Welfare Strategy (2004) has been based on the premise that farmers will adopt best practice (innovate) if the costs and benefits are clearly demonstrated to them. However, this is difficult in practice as benefits are diseases foregone, which are hard to conceptualise and subject to uncertainty whereas costs are more tangible, clearly defined and often made 'up front'. SAC is developing the Animal Health Decision Support System (see <http://143.234.192.89/wp25/>) as a way of using research to counter this problem.

Other work from SAC and collaborators suggests that in any case the profit motive for innovation in animal health may also be frustrated by socio-psychological constraints and the public good nature of some animal health related innovations¹⁰. In terms of breeding goals, for example, there is usually a poor estimation of the economic and non-economic weights of alternative traits, a difficulty in measuring these traits on animals, and lack of reward structure for selecting on them. Often there is also limited feedback from latter stages of supply chain to the producer base (although this is improving with the advent of schemes such as Wholesome Pigs).

Finally, in terms of the relationship between science and innovation 'on-the-ground', there is often a lack of reward for scientists to engage in KE activities with end users, particularly where these are seen to conflict with other demands directly linked to career progression and security (such as the pressure to produce high impact papers). As a result, research sometimes lacks the applied focus required to support innovation and/or uptake. Also, there is often a shortfall between what industry can fund itself (through for example levy funds) and the detailed work that would be needed for long term systems type work.

What are the obstacles to land managers incorporating forestry into their businesses?

With regards to the specific case of forestry, the planting of new forestry is a decision that affects agricultural activity for many years – it is a long term choice option. Willingness to adopt will depend on the decision maker perceiving that the risks associated with adoption (returns over the lifetime of the enterprise) are acceptable with respect to the likely return. Low uptake levels would suggest that land managers consider the risk-return relationship to be below an acceptable level. This conclusion may be correct or not, derived from intuitive

¹⁰ See for example: C. Heffernan, L. Nielsen, K. Thomson, and G. J. Gunn (2008) An exploration of the drivers to bio-security collective action among a sample of UK cattle and sheep farmers, *Preventive Veterinary Medicine* 87: pp. 358-372.

or considered evaluation of the choice option, based on good or poor information. Each of these elements would need to be evaluated before a full understanding of reasons why more land owners do not plant forestry was achieved. Moreover, the reasons are likely to be multiple as the values for influencing variables will differ between local and business situations.

Demographic structure of the sector

5. To what extent is the demographic structure of the sector (an ageing farming population) an obstacle to innovation; and conversely, might greater innovation in agriculture serve to bring new recruits to the sector? What incentives currently exist to encourage young people to agriculture; what further efforts might be made?

As noted in our response to 4 (above) we do not feel it appropriate to try to estimate how much the ageing demography of farmers is an obstacle to innovation in general – it will depend on the innovation and its context. We discuss in 4 (above) age as an obstacle to innovation both in its own right and in combination with discontinuity in succession. To this we would add that we do not think that bringing in new recruits would increase innovation in the short term - it would only come over time as they moved into the age/education brackets when both understanding and contextual experience are optimal for innovation (as illustrated in the continuum of understanding). Thus we see the greatest level of innovation potential occurring when the modal age and demographic distribution in the sector is coincident with that of the age of innovation. Until a more balanced demographic spread is established we therefore see ongoing challenges to innovation associated with age.

Increasing innovation as a stimulus to bring more young people into agriculture has potential where lack of innovation is a key barrier to entry. While it might generate the ‘feel’ that the agricultural sector was more vibrant, career choice decisions are (like forestry adoption) long term decision choices. As such at the decision point there must be an acceptable balance between the expected risk and reward from making the choice of a career in the agricultural sector. We feel it is questionable that a lack of innovation within the industry is a key obstacle to this – not least because the level of innovation within the many small businesses that make up the farming sector is under the direct control of the managers of those businesses and young recruits have the freedom to innovate as they wish – provided they can resource it. Hence resources (particularly financial) are likely to be of greater importance (as discussed below).

The ageing profile in the farming population is well known and the industry tends to be perceived by younger people as hard work and poorly paid, with a somewhat uncertain future. Hence, we see two particularly strong obstacles to young people entering a career in the agricultural sector. First, lack of financial returns and, second, lack of access to investment capital. As noted previously, selecting an agricultural career involves an assessment of the likely risk-reward relationship. Traditionally farm businesses supported a number of generations of a family but today income levels are often sufficient to support only one generation. Moreover, there is insufficient capital to allow older generations to retire and open opportunities for younger generations. The evidence available to young people thus suggests that the rewards are declining and relatively low (compared to other

career options), particularly taking account of the anti-social working hours which are typically required. With respect to lack of access to investment capital, the demands of agricultural activity for capital are much greater now than in the past. The days when young people could start out for example with 2 or 3 dairy cows, selling milk direct to customers and gradually building a business are largely gone. Meeting the minimum standards for Food Safety, Health and Safety and other regulations all incur considerable capital costs that can be prohibitive for small start-up businesses. More could potentially be done to facilitate capital access and its cost for young people to help overcome these obstacles and whilst some support is provided in some EU countries this is not universal.

An additional factor that may be important in biasing young people against participation in the agricultural sector is the poor image that it has and value awarded to it by much of society. It is known that profit maximisation is not the only or even main objective of most farmers, thus increasing financial incentives will not on its own encourage young people into the industry. The other motivating factors must also be addressed – including status and self worth. There is the potential to change societies general beliefs about agricultural activity through promoting what it provides in terms of the environment, animal welfare etc. in place of the few cases where poor standards have been identified.

Future challenges driving innovation forward

6. Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

We see innovation being driven forward either from within the sector to solve existing problems or from science (natural and social) where new understanding are developing along with novel applications of new understandings, or from a combination of both sets of players. It is important to recognise that the factors that affect the rate of adoption may differ between the players. For example, the availability of data and information might limit innovation from within the sector whilst demonstration/evidence of benefits/value may limit innovation from science.

Four of the key challenges that we feel will drive innovation in the future are:

- I. *Country variation*: Policy developments within the EU are applicable in all member states, yet these states are highly variable in land capability, climate, infrastructures etc. As a result the implications for businesses vary by country as well as within countries. The impacts on business competitiveness thus are not universal and can lead to unexpected consequences. Furthermore with increasingly global markets the impacts of freeing up trade can vary between different countries and can introduce new challenges where minimum standards are not universal across countries within the EU. This perceived 'unfair' or uneven spread of impacts, some of which may be undesirable, causes conflict. We therefore see that innovation in policy, trade and negotiation will be driven forward by the need to address the problem of country variation within the EU.

For example, farm businesses in the UK have already undergone much of this restructuring and the average holding size is higher than in many EU countries (average

farm sizes in UK, EU(25), EU(15) in 2007 were 53.8ha, 16.8ha, and 22ha respectively¹¹). Thus EU agricultural policies need to be able to accommodate a wide range of structural variation and support variable rates of re-structuring – this will require some innovation.

2. *Cross-border challenges non-specific to agriculture*: There are major international level challenges such as climate change that require addressing. These will drive innovation at a number of levels, including finding new solutions to existing problems, new solutions to new problems, new ways of using existing solutions, problem definition and quantification, as well as policy and trade developments. While agriculture is clearly involved in these challenges, agreements on actions are made at a higher level and may be affected by negotiations on other issues. Innovation in the realm of international negotiation and agreements is therefore likely to be driven forward by the need to come together on global issues. Moreover, innovation in the way that innovation is supported in poorer countries is likely to be driven forward by the global need for them to make progress in certain areas (e.g. when international agreements were being negotiated on the non-use of CFCs).
3. *Market failure*: With respect to market failure we note the following points:
 - o Non-market goods, externalities and multifunctionality
 - o Market power
 - o Information asymmetries

Non-market goods, externalities and multifunctionality

Agricultural activity is multifunctional and many of the joint products are non-market goods and externalities, such as landscape features, biodiversity and animal welfare. Furthermore many of the joint products are negatively correlated with the main product. The consequences are first conflicts between competing goals (e.g. environmental protection and animal welfare as discussed by Milne et al., 2008¹²) and second over/undersupply of non-market goods typically undesirable and desirable non-market goods respectively since, by implication, there is a lack of reward/penalty for provision of desirable/undesirable non-market goods.

There is then a clear need for innovation in the mechanisms by which conflicting societal goals are addressed – how do they reach the discussion table for example – and how are they resolved when there is no ‘perfect’ solution. There is also a need for innovation in how the market failures associated with non-market goods and externalities are addressed. (Government interventions in markets are always a ‘second best’ and identifying and implementing efficient and effective mechanisms that reward/penalise supply of desirable/undesirable goods to appropriate levels with minimal negative side-effects is highly challenging.) Furthermore technological innovation may help reduce the conflicts by providing new solutions that have fewer undesirable externalities e.g. water, land or air pollution (including greenhouse gases (GHGs)).

¹¹ European Union Directorate-General for Agriculture and Rural Development (2010) Agriculture in the European Union: Statistical and economic information 2009 http://ec.europa.eu/agriculture/agrista/2009/table_en/2009enfinal.pdf.

¹² Milne, C.E., Dalton, G.E. and Stott, A.W. (2008). Balancing the animal welfare, farm profitability, human health and environmental outcomes of sheep ectoparasite control in Scottish flocks. *Livestock Science*, 118, 20-33.

Market power

Primary producers in agriculture have long been price takers and their lack of market power has been increased by the loss of marketing boards and synchronous increase in power held by a small number of retailers. Furthermore in recent times global trade has been extending. Consequently the returns to agricultural activity have fallen as input prices have increased and output prices have remained fairly static. In the last few years in Britain the effect of this has become increasingly evident particularly within the dairy and hill/upland sheep sectors where significant numbers of producers have withdrawn from the respective sectors. The risk this presents to retailers (loss of supply) has already brought about some innovation in producer-retailer contracts. However as recently demonstrated by both the demise of Dairy Farmers of Britain in 2009 and discontinuation of contracts by Bird's Eye with pea producers at the start of 2010, primary producers are still very exposed to risks associated with lack of market power. Such examples have increased the awareness of these risks to producers and are likely to drive forward further market innovations in the future.

We would add that while at present supply chains are increasingly demand led and so consumers are theoretically the main influence on what goods and services are produced it is questionable whether they have the knowledge (see below) and feel sufficiently empowered to act in ways which will achieve desirable societal solutions – thus we see the market power as being held mainly by retailers.

Information asymmetries

Linking with both the problems associated with market failures noted above, consumers generally do not have a good knowledge of agricultural production systems and how the supply chain operates. Therefore they do not fully realise the true value of the goods/services they are selecting between (e.g. differential animal welfare standards of different production systems which are extrinsic attributes of competing products). Moreover as noted above many do not feel that their individual actions matter. In both cases consumers often do not recognise their responsibility within the supply chain and the consequences of their purchasing behaviour. Recognition of these aspects of market failure is driving forward innovation in labelling and other mechanisms that will facilitate a truer recognition of responsibility in consumers, including how their actions may just export a problem.

4. *Low farm income levels*: Linking with the three points above, low farm income levels will drive forward innovation in markets and government policy. This is because it is becoming increasingly evident that non-market goods must be paid for in some way if the industry is to have a future both in terms of a skilled labour force and the financial capacity to invest in innovation to achieve new societal goals (e.g. reducing carbon emissions).

With respect to who is responsible for driving forward innovation we feel that this should be spread across the sector (from primary producers to retailers), consumers, government and the EU Commission according to who has the power and opportunity – and this will vary depending on whether it relates to conception, development or adoption (deployment) of innovations. Hence when dealing with challenges relating to country variation the responsibility should be with individual country governments at all stages of innovation (for example funding research into more effective mechanisms for supporting the diverse

agricultural sector that exists between countries). Primary producers have a responsibility for all stages of innovation where there are technological or changing market opportunities. However we feel it should be accepted that this and other responsibilities are limited by their power (financial and market) to respond. Thus consumers and society should accept their responsibility to pay the cost of providing goods and services which are not valued at their true cost of provision by the market and innovate at all stages to overcome these market failures.

The responses that are required may differ between actors within, outwith and across the sectors. Thus for example some actors might see climate change as providing more opportunity for Scottish agriculture – if our climate is warmer a wider range of crops might be grown – whilst other may see it as a threat if their focus is at a global rather than local level or if at a local level it is on mountain habitats. The presence of different view points needs to be recognised and respected by all stakeholders involved in change and the risk it presents to joint working. For such instances we feel that governments are responsible for innovating and/or supporting innovation in these areas as their members collectively represent the many stakeholders who cannot effectively act alone.

Whichever actors are involved in the chain of innovation, it is critical that they are financially robust. For example, if stakeholders (e.g. farmers or universities) are in a financially sound position, they can more readily afford to take the risks involved in driving forward innovation.

Knowledge and innovation systems

7. Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

Innovation is more than just a new product or unit of IP and innovations (broadly defined) usually require 'packaging' within an appropriate innovation system. The UK may be able to learn here from other countries where demarcation between different players and processes in innovation systems is less evident. One example of an innovation system in agriculture is 'Countdown Downunder' (see <http://www.dairyaustralia.com.au/Research-and-Innovation/Farm-Research/Countdown-Downunder.aspx> for more information). In the UK, some current funding schemes produce small contained pieces of work - for example LINK TSB which can bring to market relatively well formed ideas - but often larger schemes are needed to produce united industry and collaborator projects.

We agree that innovation is best served by co-ordinated formal and informal systems of researchers, consumers (including members of the public and specific groups such as school children), producers, retailers, advisers and government. However, it is important that innovation is not seen as a linear process (i.e. research→policy→practice); the reality is a much more complex system in which communication and dialogue happen in multiple directions between all actors. The systems that are required to support innovation in EU agriculture are those in which individuals can develop along the continuum of understanding such that they can conceive innovations. Thereafter the infrastructure and other resources necessary for development and deployment of innovation need to be present – thus investment capital needs to be accessible for example, either from profit generation within a

business or from external supporters. In addition, particularly with respect to the adoption of innovations in agriculture, it should be noted that many farmers learn from others and are risk averse. Thus it is important that evidence of the benefits of an innovation are presented in ways that allow farmers to learn from seeing and by people who farmers trust – such that they will believe the predicted benefits to be realistic. Evidence suggests that farmers learn from different sources thus no one method of KE will suffice. Moreover, programmes that encourage scientists to take on board practical messages are required.

SAC engages in a range of systems of interaction that can readily be regarded as falling under this all embracing description. This ranges from informal one-to-one communication to pre-planned major events with a large number and breadth of stakeholders. The stakeholders and the formality of interaction are governed by the nature of the innovation in question and the goal sought. Combining effort between research (SAC and other research organisations) and industry (e.g. levy bodies) such as through combined open days has proved a useful way of creating a unified, authoritative approach to promoting innovations. Increased interaction between research providers and food processors and retailers is expected to benefit both the development and uptake of innovations at all stages in the food supply chain. SAC now has close links with major livestock processors and retailers (e.g. Morrisons; M&S), for example.

Research and Development

8. Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

It is critical that priorities for future research are identified from the ‘bottom-up’ as well as the ‘top-down’. Often farm advisers, farmers and other rural businesses are better placed to identify real knowledge gaps than scientists. At the same time, a higher value needs to be placed on applied research to attract and retain new scientists. Any future budgetary cuts should relate to both applied and high impact science.

We feel that the developing role of KE based discussions between researchers and industry participants (business, policy makers etc) should be used further to establish the research agenda for agriculture. With budgetary cuts and a recession, all stakeholders will find it difficult to fund research activities. However all stakeholders have a responsibility to contribute – including consumers. We feel that the ‘who pays’ should relate to who benefits and the type of good/service. Thus for example when the benefits are for society as a whole (e.g. through reducing GHG emissions) then society collectively should pay. This may either be consumers, or where there is market failure (e.g. relating to market power resulting in primary producers being price takers), tax payers. Where the benefits are entirely private and achievable for private individuals/businesses then these individuals should be expected to pay, though some supporting formal structure that brings them together may need to be initiated by government.

Education and Skills

9. What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

It is widely acknowledged that there is a shortage of agronomists, weed scientists and soil scientists. In addition, there is a shortage of scientists with an understanding of agricultural systems – in short, people who have the ability to integrate between disciplines to look at the way whole systems (e.g. a farm) actually function. This is possibly a function of specialism in education too early.

In Great Britain many specialist courses in agricultural science have shrunk or disappeared at degree level. Many new courses do not provide the same depth of scientific understanding. This is evident in Scotland where none of the universities that traditionally taught agricultural science – and had pure science department (physics, chemistry, etc) to support them – still do so. This means that there is a shortage of graduates who have the data, information and knowledge from which wisdom develops and from which innovation arises. In some of the key knowledge transfer and exchange sectors (e.g. advisory services) there is therefore now a shortage of high quality new candidates. While we are still educating some high quality students in specific sciences these individuals can lack the contextual knowledge required for ‘wisdom’. Proactive support for the provision of new courses in agriculture with a solid base in core sciences should be enhanced in order to improve the education and skills provision in agricultural research and advisory services. For the agricultural sector more widely more opportunities need to be made for CPD of primary producers – particularly in how these are funded (given low farm incomes that prevent investment in themselves).

Knowledge Transfer

10. How should research be translated into technology transfer and advice to practitioners? What are the respective roles, for example, of professional advisers, professional organisations, peer groups and the public sector?

To some extent, the optimal strategy for KE depends on the message. Participatory research approaches have a critical role to play here, but these are much more widely used in developing rather than developed countries. Involving farmers at the inception of research projects, harnessing their ideas, facilities, etc. can be rewarding for all and effectively means that the KE is built into the foundation and structure of projects.

The power of farmer-to-farmer transfer and exchange should also not be under-estimated. Again, a ‘tropical’ example can be drawn on, the ‘farmer field schools’. Few organisations offer the multi-functional and interdisciplinary capabilities needed to convert research advances into industry uptake in agriculture. SAC is unique in this regard and has much experience of KE in the agricultural sector. For example, SAC often runs ‘farmer training events’ with three parts – traditional presentations, a practical element (e.g. based on soil samples) and a social element. A few growers may make changes in response to knowledge transfer direct from researchers, and more will follow the advice and information from an adviser so the role of the professional adviser in this process should not be underestimated. SAC offers training and support to local advisers who are known and trusted by the farmer. We offer open days and trial demonstrations and local farms which are well attended.

Growers value the local element highly and will often regard results from elsewhere in the UK as irrelevant to their situation. SAC organises talks and meetings in winter months which target the more innovative farmers and the professional advisers. Web advice targets a similar audience. Monitor farms and farm business groups have been good mechanisms for changing practices in small groups of local and like minded growers. We offer BASIS training and incorporate outputs of research into this which again reaches the professional adviser and the more innovative farmers who take up this training. Written reports and publications are also used to reach growers and advisers and raise awareness of topical issues and management practices. The now defunct Defra LINK programme, which brought together science and industry, was a great mechanism for KE as it encouraged truly collaborative projects that improved knowledge without the need for a 'product' at the end.

SAC is committed to developing a KE strategy through which it will assess and then implement optimum approaches for engaging with specific end-user groups. This is likely to span the breadth of KE mechanisms, from web-based material which has proved to be a powerful way of encouraging knowledge and update of specific innovations, through to one-to-one, face-to-face contact with professional advisers who can provide bespoke advice.

The translation of research into technology that can be used by practitioners often works best in a cascade structure in which there is a translator i.e. professional adviser, who is well educated and trusted by practitioners. These translators are key as farms are highly individual in their physical and social structures; consequently the 'best' use of technology can vary and requires interpretation by someone who understands the application context. Furthermore, practitioners have individual learning styles, thus a variety of methods for technology transfer need to be used – translators typically are well versed in the appropriateness of different methods for different practitioners. Professional organisations are typically best placed to provide professional advisers as they can implement structured training programmes and ensure its quality. Peer groups will exert pressure on slow adopters and are therefore important within the technology transfer network, but are typically informal. Where the technology transfer is in the interests of the public then the public sector has a role as well as responsibility to ensure that it happens.

EU Policies

11. What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

These issues have been addressed in several of the responses to previous questions. It is important that the relevant actors in different member states work together, through cross-member state policies such as the CAP and research policy, in tackling the cross-national challenges and opportunities. Of course, such collaborative work needs to recognise the instances in which there are differences between member states. It is also critical that researchers work with the industry through effective KE mechanisms and that the impact of their work on the industry and its different players is recognised and appropriately rewarded.

September 2010

Oral evidence, 19 January 2011, Q 322-354

Evidence Session No.9. Heard in Public.

Questions 322 - 354

Members present:

Lord Cameron of Dillington (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Giddens
Baroness Howarth of Breckland
Lord Lewis of Newnham
Baroness Parminter

Examination of Witness

Witness: **Professor John Oldham** [Scottish Agricultural College].

Q303 The Chairman: Welcome, Professor Oldham. Thank you very, very much for coming to see us all the way from the North. There are various formalities to go through before we start. You have in front of you a list of interests that have been declared by the Committee members. I have to say this is a formal evidence-taking session of the Sub-Committee and a full shorthand note will be taken. That will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript—this is perhaps the bit that you may need to listen to—and you can revise it in terms of minor errors, if you wish to. I should say that this session is on record. It is being webcast live and will subsequently be accessible via the parliamentary website. We're not quite sure that there's any evidence of anyone listening in, but I tell you that for what it's worth.

Now I think you said to me just now, when we met outside, that you would quite like to explain how the SAC works as a whole, so that we get a handle on that. Perhaps I could ask you to start with a general introduction.

John Oldham: Thank you, Lord Chairman. I am John Oldham. I was formerly Head of Research in SAC up to the end of 2009. I'm now semi-retired, but part of my ongoing obligations are to sustain European linkages and develop European associations between SAC and others. For those of you who are not familiar with SAC, it might seem to be a little bit of a mongrel type of body, in that it is a higher education institution funded by the Scottish Funding Council for its education but with a different funding model for research and with a major consultancy business. We train students through diploma levels to degree and postgraduate levels. In that sense, SAC is rather like a university.

My role as Head of Research was to manage a research programme, so our programme of research is a managed programme; it is not purely serendipitous. It is supported in part by a major commission from the Scottish Government, which accounts for about 40% of our total research funding. The other funding comes from grants. It operates to a large extent rather like another of the Scottish research institutes, but embedded in this university structure. I had about 200 research scientists and a research spend of between £15 million and £20 million, which is very similar to the average research institute size. Alongside that, we have a consulting business, which is largely a commercial consulting business. Part of its activity is supported by Scottish Government to fulfil particular purposes, and the main part of that is to support animal health and surveillance issues. That business is not icing on the cake for us; it is a major part of the cake, which makes us quite a different beast from the typical university.

We are multifunctional. We have these three functions: educating students; doing research, and we're proud to say that we do applied research and hopefully it is also policy-relevant research; and we have a consulting business, where the consulting business is actually the largest third of those thirds. The research is about an exact third and education is the slightly smaller third. I hope that gives a general view of the function.

In terms of location, we are distributed across Scotland. We have three major academic centres: in Edinburgh, where I am based, in Aberdeen and in Ayr. We have a network of offices in Scotland that run from Shetland in the north to Dumfries in the south. We now have a small number of offices in England, which is a slow and steady takeover perhaps, and we also support activity in the Isle of Man and some international activities. So we are quite a distributed physical organisation as well.

The Chairman: Thank you very much. That's very helpful.

Q304 Lord Giddens: Thanks very much for coming. What proportion of your income comes from the State, from Government?

John Oldham: From Scottish Government, the total income directly from Scottish Government is about £14 million of an approximately £50 million turnover. We receive funding from the Scottish Funding Council, which of course is initially state funding but it is arm's length.

Q305 The Chairman: That's to do with research, is it?

John Oldham: No, that funds the education function. We have yet to receive any core research funding through the Funding Council, because we only became officially an HEI in August of 2008, so we did not enter the last research assessment exercise. That meant that we did not have the opportunity to win research-stream funding from the Funding Council.¹³

Q306 Lord Giddens: Commercial activities are fairly marginal then.

¹³ NOTE BY WITNESS: However, the SAC has won a major grant from the Scottish Funding Council (SFC) under the "SPIRIT" competitive programme for KE (knowledge exchange) activities. The project is worth £808k, is partly funded by Scottish Government and industry as well as SFC, and is entitled "KE for control of paratuberculosis in partnership with Scottish cattle farmers".

John Oldham: No, commercial activities in consulting account for almost two-thirds of the income, so the commercial activities are major activities. In research, we win funding competitively from a range of bodies; significantly, quite a lot from Defra. About a quarter of our total research income is from Defra, and that has been increasing in recent years, in part, I think, because we are the kind of body that does the kind of research that Defra needs, and there has been a decreasing number of bodies that will do that. We have European funding; we have levy board funding; we have a small amount of Research Council funding, but that I expect to grow in the next few years, as there was a period of time when we were deemed not to be eligible. We had a funding gap from Research Councils for a while; we have now returned to eligibility. State funding is a significant part of what we receive, but quite a bit of it is competitively won.

Q307 The Chairman: We had been told with admiration by other people that you have a more holistic system, which you have amply described. I was just wondering whether there's any evidence that, as a result of this system, you get a better flow of information and innovation from the blue sky research right down to the farmer. Does Scottish agriculture benefit in this way and is there any evidence to that effect?

John Oldham: Finding evidence of a direct link is quite hard, but I believe that there are advantages. If we take the animal health schemes for example—we have set up animal disease control schemes—those were initiated by interactions between our researchers and veterinarians, and farmers, and were developed in concert, and are more actively adopted north of the border than south of the border. They provide a very good flow of information both to farmers to help control disease, but also from farmers to identify emerging problems. It's a two-way issue.

Recently we did some work for Defra trying to look at the technical efficiency of farming in different sectors in the UK, and between the UK and different countries in Europe. This is an economic assessment of technical efficiency. That shows that there are more efficient farming units in Scotland in some sectors, in livestock in particular, which is a major part of Scottish agriculture, compared with England and Wales. In that sense, there is some evidence that Scottish farming is technically more efficient, in terms of use of manpower, energy and land. To prove a causal link between that and the research network is, I think, impossible, but perhaps it is a little bit of evidence to say that there is some degree of association there.

Q308 The Chairman: You say you're moving into England. Do you see the marketing of your services expanding?

John Oldham: Yes, but steadily; we have had a number of previous engagements with English bodies. When the MLC existed, we had a joint venture with Signet on the genetic evaluation front, which eventually we decided to wrap up because it was not working as well as we wished. We have found that, in the north of England, there is a lot of interest in using and having access to SAC services, and so we are responding to that need. How far that will evolve over time is difficult to say just now, but there does appear to be a gap to be filled and, slowly, so that we don't spread our lines of communication too thinly, we would aim to try to fill some of that gap.

Q309 The Chairman: We're an EU Committee trying to influence the way that the European Union works. Do you think there are messages within the success of your system that could be transposed, either to England or particularly to the EU?

John Oldham: Yes, I think there are. In the questions that were pre-circulated there were some questions about the usefulness, utility, of EU research. In thinking about that, I think EU research funding has been very useful to network Europe; to get people working together who previously had not worked together. That is a helpful point. It has also begun to support some projects that produce information that is potentially very useful. Where there is a gap is in the next step, where that information is then translated into outcomes in European practice.

Looking for ways to associate the users of information with the developers of information is helpful, but one of the themes that I would like to emphasise throughout this discussion is the two-way flow of that. "Scientists know best" is not a particularly helpful recipe for achieving outcomes. It is the interaction between science and end-users right from the start of activities—not at the end but right from the start—that is useful to achieve outcomes. That is what we have in Scotland and not quite so much in many other European countries. Denmark used to be very good at that. I think they have probably weakened their position over time. They used to have a wonderful network of what I would call demonstration farms; I don't think that was precisely the word they used. They were linked to the research centres and achieved that engagement. The number of those has diminished with time, and I suspect that that has weakened the translational link.

Q310 Baroness Howarth of Breckland: You've already moved into my question about the EU but, as you know, the Seventh Framework Programme for research, which runs from 2007 to 2013, has a total budget of €53 billion—we're having this for the record obviously—of which just under €2 billion are allocated to food, agriculture and biotechnology. You said a little bit about your view of the usefulness of research supported by the EU, but what might be done to improve its utility? We're particularly interested in the way money is targeted, and the target between, if you like, the knowledge and the implementation. You talked very much about being applied and robust in that. I just wondered what your thought was about European funding. We're also keen to hear about other research work and what is happening in other countries, if you can expand a little more on what you've been saying about that.

John Oldham: On the utility front, I think I have made the comments already. What can be done to improve that? Very frequently in research there is a momentum that carries people from one interesting question to the next interesting question to the next interesting question. There is less willingness to look back at what we know, bring the information together and see how to apply it. That is re-search as opposed to research, if you like. I would like to comment on some of the culture that discourages that, at some point. It would be useful, both in UK and in European funding, to take the opportunity to apply effort and fund effort to review what is known and to engage with end-users, industry, practitioners and so on in that process, and to look for ways to amplify the arena in which that knowledge is shared. It is often shared among scientists, but it isn't shared quite so widely with practitioners.

I am involved at the moment—I am an animal scientist, by the way; perhaps I didn't mention that—in a grouping of organisations that calls itself the Animal Task Force. That is a mixture of research institutions—us, Wageningen University, INRA, the Danish university in Aarhus,

the Uppsala University in Sweden—the technology platforms that relate to livestock science in Europe, which are to do with breeding, animal nutrition and agriculture, and some elements of industry. We are working together to share our views on where priorities are to try to bring a coordinated view that we have presented to the Directorates in Brussels on a couple of occasions now to say, “These are the priorities as we see them, both from a research-provider point of view and a research-receiver point of view.” We are probably too weak on the research-receiver front at the moment, but it is an activity where we are trying to produce that view to share with the people in the Directorates in Brussels. Interestingly, when we asked Brussels if they would be willing to fund this activity, they said, “No, we don’t want to fund any more platforms,” but, because we are fragmented in the livestock sector, we thought it would be useful to draw things together, so we found our own way of funding ourselves. Essentially we created a club, so there is a membership fee and we use that to fund our activities. That is the kind of thing that might be supported to help to spread awareness of issues, but it doesn’t deal with the problem of implementation of knowledge that has been acquired.

Q311 Baroness Howarth of Breckland: Forgive my cough; I’m needing research in flu. One of the things that we’ve been hearing is about the very different methods of farming across Europe. We’ve got a very fragmented view, I have to say, of that at the moment. Do you see the impact of that in relation to the way farmers work with the institutes in other countries or the other way?

John Oldham: I’m not sure that I can give a very informed view on that. If I take the analogy with the UK, smaller farms tend perhaps to be more risk-averse on occasion, so they are not necessarily so willing to innovate; they don’t have so many resources to innovate. On the other hand, smaller farms perhaps tend to be more willing to join together with others to share information. That may be true across Europe as well. Creating networks where the farming structure is made up of smaller farms, of clubs of farms if you like, rather than dealing with individuals, may be a different way of managing that knowledge exchange function, but I’m not particularly competent to comment on that.

Q312 Lord Lewis of Newnham: As far as the EU is concerned, are there any great differences between the funding for both arable and livestock research?

John Oldham: Differences in what way?

Lord Lewis of Newnham: Is the majority of the funding going to livestock? Is it going to arable or is it a mix between the two?

John Oldham: In general, the funding is very approximately proportionate to the scale of the activities in the countries that I’m aware of. I can’t think of an example where there is disproportion.

Q313 Lord Giddens: Can you send us the stuff about this Animal Task Force?

John Oldham: I can, yes.

Lord Giddens: A summary of what it's achieved and what it does. It has data on different countries, does it?

John Oldham: No, it is a discussion group at the moment. Its main outcomes have been presentations to Directorates in Brussels. A subset of the ATF membership, which includes us, Wageningen University and INRA, the French research organisation, has produced our own document on priorities through having groups of people from each of our organisations working together to distil out views and priorities from a research-provider perspective. I would be happy to copy that to you as well.

Q314 The Earl of Arran: Concerning EU innovation, you make the point, and I quote, "Innovation in policy, trade and negotiation will be driven forward by the need to address the problem of country variation within the EU." You go on to highlight the challenges in non-agricultural cross-border issues, market failure and low farm-income levels. I have two questions concerning the CAP in this context. To what extent do you think the CAP can and, indeed, should assist the farming sector in meeting such challenges? Secondly, what changes would you want to see the CAP doing to strengthen its support for innovation? Do you believe at the moment it is obstructive or is it supportive?

John Oldham: I'll start from a perspective where I believe that the total level of support to farming from the CAP is likely to diminish over time.

The Earl of Arran: To diminish?

John Oldham: To diminish over time. Therefore, the farming industries are going to need to respond to that and be innovative in response. I feel it would be helpful if the CAP was used to help support innovation now to prepare for the future, where there is likely to be less support from the CAP. That would be constructive. In order to be successful, I think it is helpful to have support measures that are for definable goals and that are monitorable, so that one can measure whether there is progress. That may be unpopular among the farming communities because, in a way, it takes away some of the safety and comfort of current cushions, but it would be preparing for the future, which may well be tougher. By saying that, I am inevitably saying that single payments, I believe, are less helpful to encourage innovation than supporting rural development. That is the direction that I think should be taken for long-term gain. There may be some short-term pain in taking that approach, but I think there will be long-term gain.

Q315 The Earl of Arran: I think there will be considerable short-term pain. Don't you?

John Oldham: Yes, but it's a balancing act. I am sure that you will have had the example of New Zealand presented to you on various occasions in discussions, and that was an abrupt truncation of support, which created a severe problem for some time. The New Zealanders have certainly risen to the challenge, but the short-term pain there was considerable, and it is avoidable if there is a longer term plan, but the longer term plan has to recognise that there will be a movement from support at one level to support at a different level, in the longer term future.

Q316 Baroness Howarth of Breckland: It really follows on from what you were just saying because, in your evidence, you were stressing the importance of what you called a “continuum of understanding” in looking at innovation. You say that “The agricultural sector will be best placed to innovate ... [if] there are sufficient resources for this activity.” You’ve just said support innovation now, but you say “including human and financial capital and freedom to deploy them ... It is particularly important to note the requirement for experienced individuals to start the process.” We really would like you to say a little more about what you mean by the human and financial, particularly the human, capital that you have in mind. Are these resources present in the UK and EU agriculture? Why are experienced individuals important? How can an entirely new technology, e.g. renewable energy, be adopted in a sector that has no experience of it? Some of the things that you’ve delivered to us give us some thought about this. We are very interested in whether or not there is a generation that continues to innovate, or whether you need to get a new generation in order to do so.

John Oldham: One needs to be careful not to generalise too much about innovation, because there are outstanding individuals who break all the rules.

Q317 Lord Giddens: Do you mean break all the rules productively?

John Oldham: Yes, and also the other case; both ways. This continuum of understanding, which I would have to say comes from colleagues rather than myself, is really a way of expressing the balance between understanding and awareness of context. I think our feeling is that that balance is not necessarily age-related, but there is a balance there. Some people come very quickly to spot opportunities to innovate, and the spotting of an opportunity is a balance between understanding what is possible in context to get a view of what will work. One of my colleagues has a very useful set of questions that he asks about any development in sciences: what is possible?, what works in practice? and what is acceptable?. Those three questions are, I find, very useful. If you apply them to GM, for example, many things are possible, many things technically work but, at the moment, some things are not acceptable. That is not a technical issue; it is a sociological issue.

Coming back to your question on the human and financial capital, we have already mentioned that many parts of the agricultural industry have relatively little financial capital with which to innovate, although there are examples where there is sufficient capital to innovate. Human capital is geared very much to lifelong training, development of awareness of opportunities and awareness of context, so that, when risks are taken, they are taken in a balanced way. Our view of experience really is a balance between risk and opportunity, which is informed by context. That is education in context, if you like. That is what we were meaning in that presentation.

Q318 Baroness Howarth of Breckland: Before you go on, could I just ask, in your experience, are there people out there with good innovative ideas and a wish to move forward, but without the financial margins to be able to do so?

John Oldham: Yes, I think so. There are certainly people who have limited financial margins but who are bold enough to say, “This is the right thing to do and we will take the risk.” Certainly the financial platform that agriculture sits on at the moment is not that strong for

risk-taking and that works against some elements of risk-taking. Agriculture is a fairly conservative, with a small “c”, business in general.

Q319 Lord Giddens: Could you give a few more concrete examples of the points you’re making in specific context?

John Oldham: In relation to the last question in particular?

Lord Giddens: For example, human and financial capital is a very general point. Do you have a specific context of agriculture in mind where you can say this worked and this didn’t work?

John Oldham: In the cropping area, for example, in a number of areas the use of GPS is becoming adopted, but it is not, perhaps, as widely adopted as one might wish. There are risks in doing that, because it is relatively expensive to buy the equipment and the returns come back more slowly. In the livestock sector at the moment, there are real opportunities for expanding the scope of the tools that we have for genetic improvement of animals, using conventional breeding techniques, but they are not adopted in some sectors, particularly in the sheep industry, because the traditional approach does not focus so much on market needs as it might do and the genetic selection tools are very much market-oriented. The attitude of many sheep producers tends to be very traditional. Does that help?

Lord Giddens: It does, yes. It always helps to have a few examples that one can keep in mind.

Q320 The Earl of Caithness: I’d like to take your mind please on a bit more about how you get information to farmers. Some of the evidence, in fact quite a lot of the evidence that we’ve had recently, has indicated that, particularly in England, the system has changed dramatically since what one might say were the halcyon days of ADAS, when one got—and I stress the word—impartial advice. Now everything is more commercial, and so what is the point of giving a farmer something that isn’t going to benefit your company? Do you see this as a problem throughout the UK and elsewhere in Europe, and do you see it as an obstacle to innovation?

John Oldham: I think it inhibits innovation. It is not a complete obstacle, because there are plenty of examples in other industries where innovation happens without having an extension service. That is to do in large part with the structure of the agriculture industry. Large industry that is built in large units has its own internal capability for gaining understanding, translating and doing its own research. Agriculture is very much a piecemeal industry, and therefore there need to be some mechanisms to allow information to be transferred around.

It almost comes back to the very first question that we considered, which is whether there is evidence that the Scottish approach is different from the English and Welsh approach. I have given a view on that; I think it is. There is a cultural issue tied up here, as far as the UK and other places are concerned, whereby a lot of agriculturally related research that is contained in university-type structures does not have the cultural connections to industry that there used to be. I started off my research life in a research institute in the south of England, a dairy research institute. I worked very closely with ADAS, and there was an ADAS person embedded in the institute, who was the person who helped to interact with

farmers. I would go out and talk to farmers, teach at the university and so on. It was quite hard work even then to join up the bits, and now there is no incentive to join things up.

I would like to comment—I think it is germane at this point—about the research culture in the UK as a whole and particularly in universities - that counts against some of the things that we're talking about now. The research culture in universities is very much driven by the RAE or has been driven by the RAE, and the consequence of that has been that there has been no incentive to young researchers or researchers at any stage to embark on research that does not produce high-impact research papers, because it is high-impact research papers that, when assessed by other scientists, are taken to indicate the quality of research that has been done. It is the case that much of the research that is relevant to practice is not likely to be published in very high-impact research journals, so there is a disincentive for young scientists and their postgraduates to engage in the kinds of research that allow them to understand the context of agriculture and then to operate in those areas. We have created a culture where we have some absolutely brilliant science going on, which is going on in its own world and it is being assessed by other researchers, in terms of quality, but the value of that, in terms of translation value into practice, is diminished.

The RAE system, if you'll forgive the analogy, is a little like asking bankers to assess the quality of banks at the moment. If assessed by bankers, everything might be brilliant, but perhaps that is not completely germane to the efficient translation of that activity for society as a whole. The RAE system has created a culture that does not provide incentives to do applied research but, from my discussions with individuals in universities, I do not think there is any lack of interest in doing applied research. I meet many people who would love to do more applied research, but it does not pay them to do it, because the rules of the game say publish in high-impact journals rather than help the farmer down the road, and that has helped to cut off the supply of people who are engaged and understand the context of agriculture. We are suffering from a shortage of supply of the kinds of people who can perform the activities that ADAS used to. In Scotland, we have maintained a better balance, I think, over time.

Q321 The Chairman: You say it's purely a financial thing. What would make scientists involve themselves more in applied research, practical research, something that would be of value on farms? What change could we make to the system to make it happen?

John Oldham: I live in hope that the change that is coming through the RAE into a REF system, the Research Excellence Framework, which will include an element of impact in the evaluation of quality of research in our universities, will help to change the culture to say that there is as much value in doing good-quality research that has impact in practice as there is in doing good-quality research that has impact in publications. We might start to see, if the REF system works effectively, the change in culture there. Young scientists are interested in developing their careers and they follow the rules of the game. If the rules of the game were changed such that there was reward in doing applied research, I have no doubt that there would be many people who followed that. We have the innate capability; it is just that it is not released because of the way we operate at the moment.

Q322 The Earl of Caithness: Just to go back, we inevitably concentrate on the UK, because that's where we get our evidence from. Do you know what the situation is in Europe? Is the research structure in Europe more akin to the Scottish structure or the rather worse English structure?

John Oldham: It varies a great deal. I would say the majority are more like England than like Scotland. The Scottish model was modelled on the American land-grant universities 100 years or so ago, when it was set up, which is a mixture of teaching, research and extension, as the Americans would say. I am not aware of an organisation with the equivalent mixture in Europe.

In the Netherlands there is very good engagement between stakeholders and researchers in the setting up of research programmes. I am very impressed by the way that they interact, and interact flexibly so, particularly in relation to opportunities for European funding, they are willing to change their national priorities a little bit to take advantage of European opportunities. We are less willing to do that. They still have a gap, though, when it comes to the downstream engagements with farmers, although they do have mechanisms, which are not as tightly structured as ours, to allow that to happen.

In France, I think there are efforts to improve the engagement now with producers. I have already commented about Denmark; I think they had a very good translational structure, which has probably weakened over time. In the new-entry countries, in the Eastern European countries, there is still more of a tradition of engagement than in some of the older European countries, but sadly my observation would say that there is a wish to achieve academic excellence and recognition in the universities there, so in a way that is possibly dropping a little bit by the wayside. That is a general impression.

Q323 Baroness Howarth of Breckland: It was just a small question really. You mentioned that a third of the funding came from Defra.

John Oldham: Of our research funding, about a quarter, yes.

Q324 Baroness Howarth of Breckland: Doesn't it depend to some extent on the funders as to what research takes place? If their minds could be changed about the way they set out their tenders, would that not make a difference?

John Oldham: Yes, it theoretically could do. The BBSRC, for example, now asks for a lot of information about how the outcomes of research will be translated into practice. I feel that there is a fair amount of window-dressing that goes into the writing of those sections in BBSRC grant applications, because the structures to allow most scientists to engage are simply not present. I go back to the comments I was making earlier: I think there are opportunities to research areas and amalgamate information from a range of projects.

On occasions when I have been on Defra review groups, one of the things that has struck me is that there can be quite a good range of projects that are reviewed, but there is no mechanism to interconnect them and there is no overarching framework that says that we are setting out to achieve something – a big goal analogous, for example, to “we are going to get a man on the moon in 10 years”. That is a big picture which then needs an approach of “this is how we're going to break that big thing down into subparts and other parts”, and then “this is how we will join them up so that, once we have the subparts, we can actually achieve the long-term goal”. If we are aiming to reduce resource use in agriculture in Europe by x% over the next 30 years, that's a big goal. That's the “getting the man on the moon” goal. We should approach such questions considering what the overall approach should be, what are the elements that we need to bring together and how we then bring

them together? We should not just do the interesting science, but also support the bringing together, so that we have solutions and not just the means to a solution.

Q325 Lord Giddens: Just before I start my formal questions, did I hear you say that you were exempt from the RAE for quite a long while?

John Oldham: We have never been in the RAE because, for peculiar reasons, our education function was supported by the Scottish Government, RERAD, the rural environment part of the Scottish Government, rather than the Funding Council, until 2008. When the polytechnics in 1993 were amalgamated into the university structure, we were what was called a central institution in Scotland. All of the other central institutions became funded by the Funding Council but we did not, so we were not officially part of that stream of funding, so we were not allowed to enter RAE. We can now.

Q326 Lord Giddens: You weren't therefore affected by this process you're describing of the RAE.

John Oldham: I have been a member of review panels, but I have not had to make a submission.

Q327 Lord Giddens: Did you raise this point about the RAE with Universities UK? It seems quite a significant point to me really. It applies in economics and other subjects too actually. The nearer you get to anything practical on the ground, the less it's esteemed by one's academic colleagues.

John Oldham: I try to take the opportunity to raise it wherever I can, because I think it is a very important point. It is not a point to say that basic research is bad; I am not saying that at all. The basic research we do is essential. Much of it is truly excellent; it is fascinating; it is lovely to work in. But there is also a place for research that is more applied and there is a continuum between the two. My organisation, SAC, is working very closely now with the Roslin Institute, the University of Edinburgh vet school and the Moredun Research Institute in a consortium, which is called the Easter Bush Research Consortium. That gives us a span, again in the livestock sciences, from very basic research—understanding how gene expression works—through to application on the ground. We run the genetic evaluation services for the UK for ruminant livestock. The offices and labs that do those two things are within yards of each other and the people talk. It is a brilliant way of linking basic understanding to translation in terms of practice within days. All bits in the chain have value, but the RAE process unfortunately has given greatest value to only one part. That is unfortunate.

Q328 Lord Giddens: It just reflects the attitudes that academics have because, as I say, it applies across a range of subjects. In economics, if you do mathematical stuff, you have high status. If you do on-the-ground welfare economics or something, you don't. I want to ask you anyway about public perceptions. You made quite a few comments in your statement so far about limitations of "scientists know best", which you mentioned, and you mentioned cultural attitudes quite a bit. You've got this quite interesting statement, and I quote:

“Innovations are often seen as having ‘hidden dangers’, with a perception that older methods of production are somehow more ‘wholesome’.” Does that reflect a public prejudice or is there something in the fact that innovation means entering into new areas, where you have risks that you can’t assess in the same way as you can practices with which you’ve been familiar for a long time? Therefore, especially when you look at the longer-term risks that might be associated with innovation, there is a certain imponderable element, which is reflected in public opinion and therefore public resistance to innovation. Is there a rationality in some forms of public feeling? Is that what you’re saying?

John Oldham: Is there a rationality in the behaviour of society? That is a very philosophical question. I am not sure that I’m equipped to answer that.

Lord Giddens: We’re talking about risk here really.

John Oldham: Risk is a terribly difficult thing. I think we all know how difficult it is to understand risk ourselves and to portray risk to others. Just sitting in the corridor outside, I was watching a number of people using mobile phones. Is there a risk from using mobile phones or is there not? They are so useful that the risk is overwhelmed by—the utility they bring.

Lord Giddens: We will know 20 or 30 years down the line. It took ages for smoking.

John Oldham: There was potential risk. BSE is a classic example of something that went badly wrong in agriculture. Practices that with more careful thought might not have been adopted were adopted. The risks of dangers to human health were then assessed by various individuals as being enormously high to moderate. At the moment, the moderates, I would say, are winning the argument, but there is still a counter-argument that says, “Wait another 10 to 20 years and see.” It is very difficult to get a perception of risk, but what can help, I think, is engagement in discussion from the earliest stages. One of the examples of a scientific development that was well handled but has lots of apparent perceptions of risk associated with it was the development of Dolly the sheep, which was an outstanding scientific advancement of understanding. It has all kinds of repercussions, some of which are thought not to be acceptable, at least by some people, but was managed through conversation and discussion. I feel that is a good example of an engagement.

We should, in developing our approach to all technologies, take into account the three questions I mentioned earlier—what is possible, what works and what is acceptable—and be forever asking ourselves those questions and engaging with interested parties. There is always a danger that the vociferous minority will overwhelm the accepting majority. That is something that I am sure you deal with almost every day in your working lives. You will know better than me how to try to deal with that, but the scientists who sit in their ivory towers I don’t think are helpful although I do think they are a diminishing breed, frankly. I think the message is getting through to many scientists in agricultural science that it does not make sense to sit apart from your colleagues in society—scientists are just other members of society—and not discuss what is possible and what is going on. It is very helpful and healthy to be open in those discussions, right from the early stages. We try to research them, but we do tend to be fairly non-controversial. We are always concerned to see our work used where we think it can be useful, and we engage with those who might use it as early as possible in our research projects, so that there is awareness, and we often get guidance, so that we are stopped from going down silly directions that are simply not going to be acceptable.

Q329 Lord Giddens: Do you think there are some formal mechanisms of consultation that should be established, which don't really exist at the moment, around the edges of innovation, especially technology and science, where the public by definition just don't have the information that the scientists do?

John Oldham: I think that there are mechanisms. How one uses approaches that make those mechanisms effective is a challenge, because society is a very amorphous thing. Trying to engage with those who may or may not object to new technologies is difficult. Sometimes there are unexpected objections that only appear once something has been announced, and up pops a view that you were not expecting. It is worthwhile trying to have some kind of forum at strategic and at tactical levels to allow discussion on new developments.

The Chairman: Thank you very much. Moving on to livestock farming.

Q330 Baroness Parminter: In your evidence, you cite some very good examples of innovation in livestock farming, but you also talk about the constraints of future innovation. Could you say a bit more about those constraints?

John Oldham: I think I have mentioned one already, which is the attitude towards the adoption of technologies that we know work and are non-controversial. We feel frustrated quite often, particularly with the sheep farmers of the UK, who we could help, I believe, a great deal, to add value to their product, but there is a lack of willingness to adopt new practices. With other issues, for example the recent discussion on the cloned animal that entered the food chain, my own personal view is that the risk to human health of products of that animal is essentially zero, but the perception of cloning as something that is potentially deleterious does seem to be quite strong in some places. If cloning were to be banned, we would all stop eating bananas, because all bananas are clones, although they are not animals of course. The transfer of some of these technologies into livestock is particularly sensitive for some.

I think that the majority of the examples that I would have in my head for inhibitions to adoption of new technologies are more in the traditional areas than in the really novel ones, and they are tied up with resistance to adopt procedures that are different from tradition. I will use the genetic improvement example, because it is quite a neat and tidy one. There is a spectrum of ease of adoption in the livestock industries, where poultry and pig production will adopt new approaches very quickly. They are highly integrated industries. Dairy cattle will also be quite efficient at adopting new practice; beef cattle, a little less so; sheep, least of all. To some extent that reflects the structure of an industry and the scale of industry in terms of the number of decision-makers involved. Financial sustainability can be tricky across the piece. I don't know if any of you are pig producers, but producing pigs is not always a very profitable industry and yet it is much more willing to adopt innovations than the sheep sector.

Q331 The Chairman: Is that because the whole industry is more integrated? It's the same with the poultry industry, isn't it? The farmers are actually being taught by the eventual recipients of their goods, almost: "We insist on these standards; do it this way; this is the best way to do it." The training comes down from the companies that are marketing their products.

John Oldham: I think that is absolutely the case. There is also a very clear market direction. There is a demand for a certain type of product whereas, in the sheep sector, you take what is available, but it's heading in that direction.

Q332 The Earl of Caithness: Looking ahead, the livestock sector is 60% of our output, yet beef cattle have gone down 12% in the last 10 years and sheep 25%. This is a cause for huge concern. You talk in your paper about genomic selection. I can see a section of the population—this goes back to the question you were answering a moment ago—immediately putting up the red flag at that and saying, “No way.” In simple terms that everybody can understand, what is the research that you know about that is potentially coming onstream that could really benefit, particularly the more extensive livestock farmers, and that would be, to meet category three of your colleague's questions, acceptable to the public?

John Oldham: Genomic selection is particularly useful to try and improve traits that are inaccessible through other means. They may well be traits to do with health, welfare and reproductive success, but particularly health, where different individuals are more or less susceptible to different diseases. There can be genetic components in susceptibility to a number of diseases. There can also be genetic variation in response to vaccination; some animals are more responsive than others. It is impossible to tease out traits of that kind with conventional recording systems. By taking a barcode picture of animals and using information from the gene level, so we have a lot more information about the way that specific genes and combinations of genes affect traits, we should be able to improve the resilience of our livestock to disease challenges.

In terms of public perception, I would have thought that that would be a good thing to do: by normal breeding, using a little bit more information about genetic make-up with the new methods that are available. The process is still the same as the old process of either AI or natural mating of animals. Nothing changes there; we just know rather more about the genetic make-up of animals and are able to make them more resilient to disease challenge, which has benefits for the animals. It has benefits in terms of the perception of the qualities of production; it has benefits in terms of greenhouse gas production, because we need fewer animals per unit of production to achieve outcomes. There are many win-wins down that route. The fact that the methodology sounds a little bit frightening should be put to one side. I am sure there are many frightening aspects to the way that motor cars are made up, which I am not aware of, but which if explained to me I would think, “Goodness gracious, do we do that?” but the outcome is a useful product.

Q333 Baroness Parminter: On that point, you said specifically on the issue of cloning that the public concern was around health. There is also the issue of animal welfare, and we've been hearing a lot in this inquiry about global food security and what that's going to mean in terms of getting more for less, both in terms of crops and livestock. Do you think in terms of those trends that, given your particular expertise, there is an increasing risk in the future for animal welfare in terms of this desire to get more for less, or do you think those can be mitigated?

John Oldham: I hope they can be mitigated, but I think there are risks. Inevitably, when one attempts to increase productivity per unit of input with livestock, there is a potential challenge to welfare, which we need to keep an eye on. We have good methods of assessing

welfare now in practice; there is a lovely technique called qualitative behavioural assessment, which is body language assessment if you like, which my colleagues helped to develop, which is now being widely used. We have the methods to assess welfare but, if we are going to push for greater output per unit of input with livestock, alongside that I think it is important that we try to make the animals that we use as resilient as possible, and genetic selection can do that. We need well-informed practices, which is where education and experience matters together with the right monitoring tools so that, where things are not right, we can make sure we identify that early and put things right. There is no doubt that there is a potential risk, but there are also the tools around to help us to moderate it.

Q334 The Earl of Caithness: Are there tools around to help reduce or combat some of the greenhouse gases that are caused by our livestock? There have been ghastly headlines in the papers, “We mustn’t eat meat anymore.” Putting that aside, where is innovation on that front?

John Oldham: A good starting point with anything to do with greenhouse gases is to reduce losses because, wherever there is loss, there is inefficiency in resource use. If those resources are feeding through to greenhouse gas production, then we should diminish them. Genetic selection and improved management are potential opportunities there. It is very easy to say that livestock do contribute to greenhouse gas production. Yes, they do in certain circumstances, but also we have far too limited a view of the way that we manage livestock systems to produce or not produce greenhouse gases. There is some very elegant work done by colleagues in France to show that, in various kinds of grazing systems with ruminant livestock—beef cattle and dairy cattle—there is actually a net carbon uptake by the system as a whole, when you look at the system as a whole. On the carbon front, those systems are actually not producing a net contribution to greenhouse gas production. The realisation of that only comes from looking at whole systems of production and not just the components. Typically a lot of research that we do is component driven; it is looking at a little bit, rather than looking at the whole context, which again comes back to this point of seeing how the bits fit together.

Q335 The Earl of Arran: It’s nothing to do with innovation at all but, from all your huge experience of livestock, are you convinced that badgers are the cause of TB?

John Oldham: I am not an expert in badgers and TB, and it is a fairly delicate topic to comment on. I think badgers are associated with TB transmission.

The Earl of Arran: A very diplomatic answer.

The Chairman: Does anybody else have any other questions? No? Professor Oldham, thank you very much, it’s been really very helpful. You’ll be getting a transcript of what you think you might have said in due course.

Agricultural Biotechnology Council, GM Freeze, Soil Association and Syngenta

Written evidence from Agricultural Biotechnology Council (IEUA 1)

The Agricultural Biotechnology Council (abc) welcomes the opportunity to provide feedback to the sub-committee on its call for evidence on innovation in EU agriculture. abc is the umbrella organisation for the agricultural biotechnology industry in the UK. The companies involved are BASF, Bayer CropScience, Dow AgroSciences, Monsanto, Pioneer (DuPont) and Syngenta. Our goal is to provide factual information and education about the agricultural use of GM technology in the UK, based on respect for public interest, opinions, and concerns.

The submission below reflects the opinions of these companies and of abc's Europe-wide parent organisation EuropaBio. EuropaBio represents the interests of biotechnology industries covering agricultural biotechnology, industrial biotechnology and healthcare biotechnology.

Definition of “innovation” in the agricultural context

We have outlined above how we currently perceive “innovation” in the agricultural context, but we would welcome views on your interpretation of innovation in the agricultural sector.

Committee interpretation:

“We consider “innovation” to refer to: new technologies, such as biotechnology and new machinery; incremental change, such as commercial decisions to plant a new crop or alter a label; and to the more generic processes by which ideas are conceived, developed and deployed throughout the agricultural sector.”

1.1 abc's primary purpose is to communicate information about the use in agriculture of GM technology. However, it should be noted that GM is but one of a number of tools in the armoury for farmers to tackle the major challenges of the future – that of climate change, population increases and ever decreasing resources such as soil, water, energy and minerals.

1.2 GM technology does not exist in isolation. Effective use of GM relies on other innovations in agriculture such as the use of crop protection products and modern management techniques. abc does not believe that the technology constitutes a ‘silver bullet’ providing all of the innovative solutions required for European agriculture to meet the demands placed on it, but must be part of the mix of technologies available to farmers now and in the future to improve productivity, and to reduce the carbon footprint and the environmental impact of farming. abc broadly agrees with the definition set out by the Committee, however we would add that there should be some recognition of the use of advanced farm management techniques as a way of sustainably producing more food.

Innovation in EU agriculture as a strategic objective

The EU believes that innovation and knowledge are key to the EU's economic growth and that all sectors should play their part. Do you agree that innovation in EU agriculture should therefore be pro-actively encouraged? Alternatively, do you see agriculture as a distinct sector faced with particular challenges to which the sector will inevitably react in an innovative manner?

- 2.1** abc believes that the use of biotechnologies is essential for outputs from agriculture in the EU to remain competitive on world markets. It is also essential if the EU wishes to build a research and development base in the longer term to further develop the technology and the techniques needed to maximise the benefits to farmers and consumers.
- 2.2** Agricultural biotechnology could play a key role in achieving European public policy aims such as improved agricultural sustainability, CO₂ emissions reduction, higher resource and energy efficiency and increased productivity. Indeed, the use of agricultural biotechnology can help the EU achieve economic, ecological and social goals in the coming decades.
- 2.3** Aside from the need for a proper strategy to foster biotechnological innovation, the EU must first examine its dysfunctional regulatory system for the approval of agricultural biotechnologies for cultivation. The existing set-up is beset by political interference by those ideologically opposed to the use of the technology per se, and decision making has not been based on scientific evidence. This has led to a moribund approvals process whereby only two out of 25 products awaiting approval have actually been authorised for use in the EU.

Innovation today

How is EU agriculture innovating now? Can you explain under what conditions the agricultural sector is best placed to innovate? Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?

- 3.1** A recent successful example of an approval of a GM trait for cultivation is BASF's Amflora potato. This utilises a GM trait to produce pure amylopectin starch used in certain technical applications (it is not used for food). It took 13 years for the potato to be approved by European regulators – and is only the second GM product to be approved for cultivation in the EU, despite hundreds of products now available globally.
- 3.2** Amflora is being grown in parts of Germany despite the activities of vandals. It is estimated that the amylopectin trait provides several hundred million pounds of added value to the supply chain. This could potentially be lost if growers are unable to securely plant Amflora – this has been a long running issue for the industry and one that can hinder the development of new traits and reduce the desirability of using Europe as a base for research.
- 3.3** British farmers could benefit in the future from growing crops used for food, feed, fuel and fibre, running into hundreds of millions of pounds, but significant hurdles remain in the approvals process as highlighted elsewhere in this submission.

Obstacles to innovation

What are the current obstacles to innovation? Is there a shortfall in research capacity and in technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their businesses?

- 4.1** The process for approving GM traits for cultivation by EU farmers has been beset by delays and political interference over the past 14 years. Only two products from over 25 waiting for assessment have been approved for cultivation in the European Union throughout this time, despite a rigorous safety process. As a result, it has suffocated the development of UK and EU based innovation and has acted as a disincentive for companies to develop crops optimised for European use.
- 4.2** This contrasts sharply with other parts of the world which have embraced the technology through robust safety regulation and science based decision making. Last year 14 million farmers in 25 countries chose to grow GM crops on 134 million hectares of their land, an area over five times that of the whole of Great Britain. Over 90% of those using the technology are resource poor farmers from developing countries keen to maximise the effectiveness of their crops and protect their incomes. Burkina Faso, for example, already grows more GM crops than the whole of the EU put together.
- 4.3** For the benefits of GM technologies to be realised by European farmers and consumers, the following issues need to be addressed:
- √ Field trials must be allowed to take place with a very low risk of disruption
 - √ European and country approval for cultivation must be based on scientific understanding of the new product
 - √ Politicians will have to set out clear policy in the area of the use of science and technology in agriculture, giving farmers the confidence to grow such crops without interference where a market exists for their produce

Future challenges driving innovation forward

Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

- 5.1** The major challenges facing European agriculture include food security, climate change, increased demand and resource scarcity. The Food and Agriculture Organization of the United Nations (UN FAO) has estimated that we will have to produce 70% more food for an additional 2.3 billion people by 2050.
- 5.2** These challenges will require further innovation in the agricultural sector to meet the requirement to produce more food on the same amount of land with less certainty over climatic patterns. Recent increases in wheat prices due to drought in Russia illustrate the potential threat to food security posed by extreme conditions.
- 5.3** abc is of the opinion that the use of GM technology can help as part of a mix of technologies and techniques to help improve the reliability of the food supply. However,

without the ability to market such products in Europe, less and less will be invested in research and development by biotechnology companies and Europe will fall further and further behind in the global commodity market.

5.4 EU policy on GM is influenced by a cacophony of opinions from various stakeholder groups involved in the process. abc believes that any decision making should be based on a scientific understanding of the benefits, and potential risks, of approving the cultivation of certain GM traits. Ultimately, without a significant change in direction food security in Europe will deteriorate as agricultural competitiveness falls further behind those other parts of the world that have embraced GM and the EU will become more susceptible to market volatility

Knowledge and innovation systems

Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

6.1 Research and development supported by abc member companies would benefit from a science based approvals system for new GM products and traits. Currently, due to political interference and a moribund approvals process, there is a powerful disincentive for abc member companies to invest in future development or to enter into meaningful partnerships with Member State governments.

6.2 Some research is undertaken via publicly or privately funded initiatives, including in the UK. However such initiatives tend to be small scale evaluation trials due to the lack of a potential market for GM technologies in Europe. The EU risks falling further and further behind other competitive regions – most notably the USA, Brazil and China – in the area of agricultural biotechnology if it continues to block the cultivation of GM products.

Research and Development

Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

7.1 As indicated elsewhere in this submission, abc believes that the main block to the funding of research into new agricultural biotechnologies is the European approvals process. Without a correctly functioning process, companies will not be willing to invest large sums in product development within the EU.

Education and skills

What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

8.1 abc believes that the translation of scientific work to meaningful on-farm advice is an area of deficiency in the UK, with extension services essentially a thing of the past, at least in England and Wales. We believe that this is an area that does need further work, and

look forward to the forthcoming report from the All-Party Parliamentary Group on the Application of Science and Technology in Agriculture.

EU policies

What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

- 9.1** CAP has a role in improving the competitiveness of European agriculture but it is only one of a number of areas of EU policy that have an influence. With the CAP having moved away from market intervention, there is a need for DG Agriculture to look at the bigger picture, ensuring a better understanding of the impact of other EU policy areas – and influencing those policy areas in order to preserve and promote the competitiveness of European agriculture. What is clear is that any CAP reform must not stifle the very real need for innovation in agriculture if we are to achieve the public and political desire for safe, high quality affordable food in the UK and Europe. CAP subsidies should not be directed toward non-productive methods of farming.
- 9.2** abc believes that GM policy is best decided upon at an EU level to ensure a level playing field for European farmers. Recent proposals from Commissioner Dalli for the responsibility for cultivation approvals to be devolved back down to the nation state level do not constitute a solution to the problem of the existing process being prone to political interference. Indeed, renationalisation would, we believe, enable some Member States to utilise economic and social factors as reasons for blocking approvals.
- 9.3** abc believes that decisions related to cultivation of GM crops should be based on scientific understanding, rather than pandering to negative campaigns that do not reflect the reality of what cultivation entails.

24 September 2010

Written evidence from GM Freeze (IEUA 11)

Summary

Agriculture in the European Union must urgently innovate to enable it to adapt to a changing climate and rising prices and availability of fossil fuels and mineral resources and to restore biodiversity, and natural resources to a sustainable condition and to meet the aspirations of EU citizens.

Innovations required include;

- The wholesale adoption of agroecological agriculture as recommended in the IAASTD report in 2008.
- Reallocation of R&D funding to agroecological disciplines and away from the over emphasis on genetics and genetic modification.
- Ensuring that the new agroecological methods are adopted quickly by a publicly funded advisory service including innovations such as farmer to farmer training to keep costs as low as possible
- Ensuring that declining academic disciplines essential for agroecology such as soil science, mycology and agronomy are re-vitalised
- Addressing the need to encourage young entrants into farming through the use of the creative use of the Rural Development Fund.
- Investment in traditional plant breeding, including modern approaches such as Marker Assisted Selection.
- Addressing the market power of companies in the agricultural supplies, commodities and retailers to ensure there is shift in balance in favour of farmers and consumers.
- Addressing the dwindling numbers of pollinators in the farmed landscape through innovative use of CAP agri-environment payments.
- Enable the private sector to be actively involved in dissemination of ideas and the development of new technologies, for instances in the management of organic wastes so that they are returned to the soil.
- The adoption of schemes to retain the collective knowledge of older farmers about such areas as the local environment, soils and landraces of crop species.
- Encouraging innovation in farm ownership and marketing to bring farmers closer to their customers.
- Encourage a shift away from meat and dairy consumption to plant proteins for public health and environmental reasons.
- Ensure that labelling and consumer information aids the marketing and purchasing of food produced using agroecological methods.

GM Freeze

GM Freeze is an alliance of 30 organisations calling for a moratorium on GM foods, the growing of GM crops for any purpose and on patents on genetic resources in agriculture, food production and forestry until the need for and safety of GM technology has been established and alternative approaches have been fully evaluated.

Our members include consumer groups, farming organisations, environmental groups, development agencies, religious groups, animal welfare groups and food companies.

I. Introduction

I.1 It is clear to GM Freeze that agriculture across the whole of the EU has to be extremely innovative in the next decade and that changes in the Common Agricultural Policy must enable innovation across a very broad area if the majority of EU small and medium sized farmers are going to be able to survive economically and make a telling contribution to reversing the damaging trends of industrial agriculture toward more sustainable development. We are pleased the definition of “innovation” adopted for this enquiry is broad and is not solely confined to technological developments. One of the most crucial areas of changes required is in the structure of the markets towards one that encourages young innovative farmers to thrive and to do so without the need for massive capital investment and at a scale that keeps them in touch with their customers.

I.2 There are many urgent issues facing farmers in the next decade which require co-operation right along the food chain and beyond to solve, mitigate or encourage:

- Climate change impacts on EU farmers and the environment.
- Agriculture’s contribution to ensuring that greenhouse gas emissions are kept below levels at which climate change becomes dangerous.
- The decline in biodiversity on land.
- The decline in biodiversity in agricultural crops and livestock.
- Peak oil.
- Peak phosphate.
- Enhancing the quality, and hence productivity, of soils through better husbandry.
- Improving the quality, management and efficient use of water.
- Improving the management and efficient use of natural resources.
- Protecting marine ecosystems from further degradation and reversing the decline in fish stocks and other parts of the food web.
- Making farming attractive and profitable for young entrants of either gender.
- Prevention of EU CAP and trade policies adversely affecting the environment, health and livelihood in third countries.
- Ensuring that the market for food and other land based products such as fibre, timber and medicinal crops is fair by addressing the current imbalance of power which currently lies with seed and chemical companies, commodity companies and retailers at the expense of farmers and consumers.
- Helping farmers ensure they can be more responsive to the needs and demands of people who eat their products rather than companies along the chain.
- Ensuring that EU agriculture policy provides a healthy and balanced diet to all citizens regardless of household income.
- Enforcement of existing environmental regulations applied to agriculture to prevent damaging practices which undermine the businesses that do obey the rules.
- Enforcement of animal welfare laws in farming to prevent harmful practices which undermine the businesses that do obey the rules.
- Improvements to food and feed labelling(including animal products) to enable innovative farmers who are pushing ahead on production, welfare and environmental standards to make their products stand out for potential customers.
- Reducing the huge amounts of wastage right along the food chain from farm to plate (WRAP estimates that 5.3m tonnes of household food waste was avoidable¹⁴ each

¹⁴ WRAP, 2009. Household Food and Drink Waste in the UK

year and this excludes waste further up the chain such as crops that are ploughed in and losses during packing and processing).

- Ensuring that food is fairly traded and that farmers are not disadvantaged by unscrupulous practices including ensuring that the newly created supermarket ombudsman is effective.

1.3 In our view the most effective way to meet these varying demands is the widespread adoption of agroecological approaches to land management as advocated by the IAASTD report in 2008¹⁵. This would enable us to protect, and to the degree required restore, the natural capital of agricultural land which has been so eroded over the last six decades of intensive production and to help break the unsustainable over reliance on fossil fuels and other limited natural resources (like phosphorus).

2. How is EU agriculture innovating now?

2.1 There are many examples of where agriculture is already responding to these pressing demands. For example:

- The expansion of organic and agroecological techniques, where fertility of the soils is built using indigenous resources rather than fossil fuel and mineral based fertilizers and cultural and biological controls for pest and disease control.
- The development of local food distribution for example vegetable box and meat box schemes in the UK.
- The development of Community Supported Agriculture.
- The development of products which meet the demands of customers, for example the growth in dairy products produced without GM animal feed in Germany and Austria, eg sales of Campina have increased 15% since they offered milk produce without GM crops to the customers¹⁶.
- An excellent example innovation in non-chemical pest control is the use of decoy crops to control potato cyst nematode. This method was developed at Scottish Crop Research Institute and has been taken up commercially by Greenvale in the Decyst product¹⁷. Used in the rotation *Solanum sisymbriifolium* (a non-tuber producing relative of potatoes) is sown in the spring and fools potato cyst nematode into hatching because it exudes a similar chemical from its roots as potatoes. The PCN fail to reproduce in the absence of any tubers to infest and the numbers of pests decline. This method is used to clean up infested land although long rotations between potato crops (7 years) is the most effective way to avoid the pest. In addition, *Solanum sisymbriifolium* can be incorporate into soil as a green manure once its main purpose has been achieved. The use of trap crops removes the need to used chemical nematicides and for the introduction of GM PCN resistant potatoes. Commercial pressure to grow potatoes too frequently on the same land have made the PCN problem worse. Regulations in Northern Ireland and Scotland (pending) prevent the planting of potatoes on land already infested with PCN.
- A good example of innovation in plant breeding is the Sárvári Research Trust based in North Wales that in the late 1990s recognised the potential for potato varieties

¹⁵ IAASTD, 2008, Agriculture at a Cross Roads Synthesis Report A Synthesis of the Global and Sub-Global IAASTD Reports

¹⁶ See http://www.traceconsult.ch/index.php?option=com_content&view=article&id=167:campinas-landliebe-forces-qgmo-free-causing-sales-to-rise-by-15-percent-in-total-&catid=47:newsticker&Itemid=50&lang=en

¹⁷ See <http://www.greenvale.co.uk/growers-content/agronomy-technical-services>

produced by the Sárvári family in Hungary to produce strains with a very high level of resistance to potato blight¹⁸. The Trust has successfully bred 6 varieties which are already on the National List of Varieties but so far they have failed to break through into the supermarket markets due to the conservatism of the supply chain when it come to new varieties.

- Using the growing knowledge of genomics many plant breeders are using a technique known as Marker Assisted Selection (MAS) to speed up the production of crop varieties with a particularly trait. MAS was used by the Scottish Crop Research Institute to develop winter barley varieties with resistance to Barley Mild and Barley Yellow Mosaic Virus¹⁹. There are many other examples of where this technique has been used in conventional plant breeding which has many advantages over genetic engineering including the avoidance of the GMO regulations and meeting the demands of the majority of the population to avoid GM food and feed (in a 2010 opinion survey in the UK 72% expressed a willingness pay extra for animals products produced without using GM animal feed²⁰).

3. Can you explain under what conditions the agricultural sector is best placed to innovate?

3.1 Agriculture is at its most innovative when financial viability is backed with investment in publicly funded crop research, plant breeding and accessible extension services. The UK is one of the few countries in the world which does not provide a state agricultural advisory service. Since the privatisation of ADAS, on-farm agronomic advice has mainly been given by people with strong links to the agro-chemical companies. Hence solutions offered have had a tendency to favour the use of farm chemicals, with attached economic and environmental costs and increased influence of agro-chemical companies over farming, rather than cheaper, more sustainable, more socially acceptable agroecological approaches. The lack of independent advice to farmers will impede progress towards tackling major issues, such as the escalating costs of fertilizers, and cause the UK to miss out on the long-term environmental and economic benefits that would come from reducing dependence on non-renewable resources for fertility and pest control.

4. Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?

4.1 A good example of where there is clear agronomic benefit being missed so far is the failure of agri-environment schemes to include the creation of conditions favourable to pollinating insects (management of arable margins may be a crucial as just allocating the land²¹). Often cereal margins can lack the flowering plants which sustain honey bees, bumble bees and other pollinators when crops, such as oilseed rape, are not in flower. Pollinators would benefit the farmer by increasing yields but not if they are absent from the farm or present in too low numbers to deliver the full potential increase. The value of wildlife land for crop yield has been demonstrated by research in Canada²² where researchers found that

¹⁸ See <http://www.sarvari-trust.org/>

¹⁹ See <http://www.scri.ac.uk/research/genetics/GeneticsAndBreeding/cereals/mabinbarley>

²⁰ See <http://www.gmfreeze.org/page.asp?ID=436&iType=1083>

²¹ Smith H et al, 2009. Short term successional change does not predict long term conservation value of managed arable filed margins, *Biological Conservation* 142 pp 813-822

²² Morandin LA and Winston ML, 2006. Pollinators provide economic incentive to preserve natural land in agroecosystems. *Agriculture, Ecosystems and Environment* 116 pp 289–292

yield and profit could be maximized if 30% of land within 750 metres of the crop was uncultivated.

5. Obstacles to innovation What are the current obstacles to innovation? Is there a shortfall in research capacity and in technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their businesses?

5.1 There are many obstacles which prevent farmers from adopting innovative approaches to farming, marketing and, in particular, the adoption of agroecological techniques which are needed immediately :

- Falling numbers of academic experts in key scientific disciplines such as conventional plant breeding, soil science, and entomology
- Low level of investment in key research areas.
- Over emphasis on genetics and genomics in research agendas at the UK's main institutions including a preoccupation with patenting gene constructs.
- Lack of public investment in conventional plant breeding, which in the past has been highly successful in developing high yielding varieties of cereals, to meet the needs of the future when climate and water supply will be less reliable.
- Failure of many counties to ensure that research findings are applied by farmers. The lack of a publicly funded extension service in the UK means that farmers rely too heavily on commercial agronomists whose *raison d'être* is selling products rather than effective and efficient farming.
- Lack of development of plant protein crops for human consumption which can be grown in the UK.
- Failure of public health campaigns to reduce the consumption of meat and dairy on health grounds
- Patents on genetic constructs can be used to control access to genetic resources which might be valuable to other plant breeders and can also prevent or delay research into the safety of GM crops by independent researchers.
- Previous governments have encouraged "near market" research, which leads scientists to adopt GM or chemical approaches rather than agronomic solutions based on agroecology that do not always lend themselves to repeat marketing and sales. The recent speech by the Secretary of State for Business, Innovation and Science suggest that the current government will continue to encourage research/business partnerships rather than to foster public science²³.
- Innovation can also be stifled by lack of money to invest in local marketing and processing of farm produce, although there are thousands of good examples of such projects being successful and in doing so reducing the environmental footprint of food production, increasing rural employment and improving local economies.

5.2 In their report *Reaping the Benefits. Science for Sustainable Intensification of Global Agriculture*²⁴ The Royal Society highlighted several scientific disciplines which are at the core of agroecological R&D such as agronomy, plant pathology, soil science, microbiology, weed

²³ See <http://nds.coi.gov.uk/content/detail.aspx?releaseid=415357&newsareaid=2>

²⁴ The Royal Society 2009 *Reaping the Benefits. Science and the Sustainable intensification of global agriculture*. October 2009.

science and entomology which they said were “in decline” in UK research institutions. This creates a serious potential knowledge gap as experts retire, opening the possibility that the UK will become increasingly dependent on other countries, or private corporations, for such knowledge in the future. A revitalized knowledge and skills base in agroecology in our universities and institutions would also been extremely valuable in providing R&D assistance to farmers and institutions in the Global South.

6. Demographic structure of the sector

To what extent is the demographic structure of the sector (an ageing farming population) an obstacle to innovation; and, conversely, might greater innovation in agriculture serve to bring new recruits to the sector? What incentives currently exist to encourage young people to agriculture; what further efforts might be made?

6.1 As we have indicated above young entrants into farming are urgently needed. However, the current economic climate in the livestock sector is hardly encouraging young entrants to become farmers. According to the NFU ²⁵ 9% of dairy farmer intend to leave the industry in the next two years suggesting that further intensification, employing fewer skilled people will be a continuing trend. It is widely stated that the average EU age of farmers is creeping upwards although data on the age structure of farm workers is harder to obtain. The European Council of Young Farmers reports that only 7% of EU farmers are below 35 years of age and nearly one third are over 65 years²⁶. Thus EU agriculture is fast approaching a crisis when thousands of farmers will soon stop farming and with them will go their collective knowledge, much of which relates to their local environment and landraces of crops, unless urgent action is taken. The IAASTD report highlighted to need for science to make use of local knowledge and that it was a valuable as scientific discovery in developing future solutions. In the short term, there should be an EU wide initiative to transfer the collective knowledge of farmers and conserve agricultural biodiversity before any further losses occur.

6.2 Finding young entrants will not be easy because of the perception that farming is an ailing industry due to poor returns on labour and capital investment, the nature of the work, the high capital required to acquire land and to obtain the technology required on modern farms. To overcome these barriers, imaginative use of the Rural Development Fund will be required to instigate new ways to enable young farmers to get a start and maintain their motivation (and economic ability) to continue, for example:

- Share farming (where the landowner and tenants share the profits of the enterprise allowing young farmers to get a toe hold in farming). Later, when their enterprise is built up, a gradual transfer of land ownership may be possible.
- Community Supported Agriculture in which consumers buy shares in the farmer's crops before harvest, thus forging a strong economic link between the farmer and her/his customers, which greatly improves the farm gate price compared with dealing with supermarkets or the open market. This surety of income enables farmers to invest in new equipment or diversify into other crops or processing.
- Co-operatives.

²⁵ See <http://www.nfuonline.com/Your-sector/Dairy/News/NFU-summary-of-the-2010-DairyCo-Farmer-Intentions-Survey/>

²⁶ See <http://www.ceja.org/english/>

- Development and expansion of mentoring, apprenticeship and other skills and knowledge transfer schemes to retrench the body of information and experience held by farmers approaching or in retirement.
- Improved discussion of food and farming in schools, both in canteens and the classroom, to encourage a citizenship more fluent in and appreciative of the demands of modern farming and properly valuing food.

7. Future challenges driving innovation forward

Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

7.1 The biggest challenge facing agriculture is how to continue to produce food without further damaging biodiversity, the soil and natural resources and restoring them to a sustainable level. IAASTD pointed out that intensive farming systems could not continue because of the harm they cause to the environment including vital components which humans are dependent upon such as soil and water resources. This led the IAASTD panel to the conclusion that agroecological approaches to land management were the way forward. Feeding the population of the EU with a balance diet without further damage to EU soils and biodiversity, and further harming the areas of the other parts of the world we rely upon for supplying the food, feed, fibre and increasingly biofuels that we do not grow ourselves, will require changes in farming systems including:

- Conversion to less intensive animal husbandry including improving reliance on home produced feed and forage.
- A shift in the human diet towards one which contains less animal protein and fats (meat and dairy).
- Dealing with all aspects of our chronic food waste problem, including on farm, in storage, transports and homes.

7.2 Farmers will play a key role in these changes but will only respond if there is clear leadership and public support. The EU's CAP reforms could be used to start the changes needed to get EU farming back into balance with the environment and the rest of the planet.

8. Knowledge and innovation systems

Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

8.1 Implementing a change to an agroecological approach to farming in the relatively short timescale will have to be very well co-ordinated. To achieve the changes required, serious consideration should be given to developing farmer to farmer training and farmer field schools which have been employed with some success in Africa. In some circumstances, farmers across whole catchment may need to be trained so they can work collaboratively to, for instance, reduce water pollution from pesticide applications or minimise soil and phosphate losses.

8.2 In other areas, as pointed out above, better regulation and enforcement in industrial farming and retail sectors would ensure true costs are paid for damage done. Other suggestions above for the education system, consumer information and in the retail sector would also help.

9. Research and Development

Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

9.1 As we have indicated earlier many key disciplines which are required to develop and agroecological approach to agriculture in the EU have been underfunded for many years. There will have to be an investment in developing young scientists with the necessary expertise otherwise sooner or later the UK will hit a skills shortage. Investment in farmer to farmer training will keep the costs of the transition under control. However, the fact has to be faced that, as with the UK's railways, there is a price to be paid for years of neglect. In our view public investment in agroecological R&D and extension services is essential and will be viewed by future generations as money wisely spent. The Science Research Councils should reallocate their funds so that these needs are met from within their existing budgets. This will mean reducing expenditure on genetics and genetic modification, which has received millions in public money and shown very little in return to date.

9.2 For example, The Sainsbury Laboratory in Norwich has received £1.7 million from the BBSRC in the past decade to develop GM blight resistant potatoes (see table below for details), which are still many years away from commercial development even if they perform as predicted.

Grant number	Description	Duration	Amount
BBC0075221	Isolation of new potato genes for resistance to <i>Phytophthora infestans</i> from wild diploid <i>Solanum</i> species	05-08	£353,381
BBE52718X1	Late blight resistance and elevated flavonoid composition for potato improvement	07-08	£112,179
BBG02197X1	A pipeline of resistance genes to <i>Phytophthora infestans</i> from wild <i>Solanum</i> species and their accelerated isolation using Illumina sequencing methods	09-12	£750,648
PI3270	Genetic and molecular characterisation of resistance genes to <i>Phytophthora infestans</i> (late blight) in diploid potato species	01-04	£241,392
BBE0248821	Understanding host plant susceptibility and resistance by indexing and deploying obligate pathogen effectors	07-10	£277,434
Total			£1,735,031

Source: BBSRC database

9.3 In contrast the Sárvári Research Trust has not received any grants from the Research Councils at all. Despite this the Trust has already brought six varieties of blight resistant

potatoes to market which offer many other advantages for an agroecological approach to farming in the future in addition to blight resistance For example they:

- are resistant to virus diseases,
- have a vigorous growth with naturally suppresses weeds,
- are deep rooting makes them drought tolerant.

9.4 An example of where Defra has provided some funding is the research carried out by the Organic Research Centre into maximising the benefits of increasing genetic diversity within the crop by intentionally planting several varieties (diverse populations). This diversity enables the crop to adapt the prevailing weather conditions in any one season far better than a monoculture of all the same variety. Farmers have no way of knowing what challenges their crops will face at the time of sowing, so genetic diversity can improve resilience to weather extremes, pests and diseases which can vary from year to year. This type of development fits well with the agroecological model proposed by IAASTD and has already produced promising results²⁷.

9.5 Some aspects agroecology present excellent opportunities for the involvement of the private sector, for example developing innovative methods for handling organic wastes from all sectors (domestic, commercial, industrial, forestry and agriculture) in such a way as to use the materials to produce renewable energy and ensure that the maximum amount of organic material is incorporated into soils. The recovery of phosphates from liquid effluents will be essential as phosphate prices increase. Once again the private sector could play a crucial role in developing phosphate stripping techniques and the design and construction of reed beds at sewage treatment plants.

9.6 At present many livestock farms manage slurries and farm yard manure in a way that guarantees that there will be substantial losses of nitrogen either as gas (ammonia²⁸ and nitrous oxide²⁹) or in leachates and emissions of the potent greenhouse gas methane. This is another area where the private sector could provide equipment and management advice to farmers.

10. Education and skills

What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

10.1 As we have already indicated there is a serious skills gap in the field that are needed for the transition agroecological agriculture. This is not a gap that can always be filled by industry because many of the approaches are about crop or soil management which do not fit well with the products and marketing of larger agro-chemical companies, although there may be a niche for smaller, independent consultants.

10.2 Given the gravity of the situation and the requirement for a rapid transition, there is a very strong case for the formation of national agricultural advisory service. It would be wise

²⁷ Döring T and WolfeM, undated. Stabilising wheat yields can genetic diversity increase reliability in wheat performance? See

http://www.efrc.com/manage/authincludes/article_uploads/Research/Plant%20breeding/TAG%20Bulletin%202022%20Elm%20Farm.pdf

²⁸ Defra, 2003, Ammonia in the UK.

²⁹ William JR,et al, 2000. Nitrogen losses from outdoor pig farming systems, SoilUse andManagement 16, pp 237-243

to look at various models from around the world so that a UK service could be based on best practice.

11. Knowledge transfer

How should research be translated into technology transfer and advice to practitioners? What are the respective roles, for example, of professional advisers, professional organisations, peer groups and the public sector?

11.1 Successful knowledge transfer is a key part of the transition to agroecological methods. This requires innovative thinking and as we indicated in the paragraph above we should seek to learn from others. On-farm schools and farmer to farmer training would probably provide a very good way to get best practice adopted by the vast majority of farmers. There will also be a role for the voluntary sector in promoting and advising on improvements to biodiversity. However, it would be foolish to believe that such a transition can be done cheaply and a substantial re-allocation of the current agricultural R&D budget will be needed to make it happen in time to make a real difference.

12. EU policies

What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

12.1 The transition to agroecological farming is an essential and major step for UK and EU agriculture. The CAP must build on current agri-environment schemes to encourage farmers to put all their land under agroecological management. Allowing farmers within geographical areas, such as catchments, to collaborate in protecting water resources, soil and creating habitat mosaics to allow wildlife to flourish in the farmed landscape will be an important innovation of a reformed CAP.

A significant switch of funding to agroecological research across the EU would help provide farmers with the research base they need to help with a smooth transition over the next two decades. Such a change should require researchers to start to look more into whole farming systems and how they can be made to work better to achieve a sustainable future for farming in the EU. One of the recommendations of the IAASTD was that research should involve farmers and this should be implemented in the EU as part of the changes to the Framework Programme. Farmer involvement can extend to participatory plant breeding at local level and harnessing the knowledge of soils, pests and weeds which farmers collectively hold.

September 2010

Written evidence from Syngenta (IEUA 23)

Syngenta welcomes the opportunity to respond to the House of Lords inquiry into innovation in EU agriculture. We believe that the inquiry is both timely and important, ahead of discussions in Europe regarding the Common Agricultural Policy (CAP) and the Framework Programme for Research and Development as part of the negotiations for the EU Budget 2014-20.

As one of the world's leading agribusinesses we feel well placed to offer a perspective on the questions asked by the committee in its call for evidence. We are committed to promoting sustainable agriculture through innovative research and technology with a global workforce of 25,000 operating in every major agricultural market in the world.

In the UK, we are unique amongst our peer group by having R&D, manufacturing and commercial operations located here. Our Jealott's Hill research centre in Berkshire employs over 1000 people, including a number of world's leading plant scientists and boasts the largest commercial R&D glasshouse in Europe. We take this opportunity to invite the committee to visit Jealott's Hill as part their inquiry to see firsthand the cutting edge innovation that is being undertaken on site.

Our responses to the questions below provide an overview of our position. But should the Committee look to take oral evidence as part of this inquiry, we would welcome the opportunity to further develop the points we raise.

Responses to questions

Definition of "innovation" in the agricultural context

We have outlined above how we currently perceive "innovation" in the agricultural context, but we would welcome views on your interpretation of innovation in the agricultural sector.

We generally agree with the committee's perception of 'innovation'. Agricultural innovation certainly relates to both the application of science through technology and to the development and uptake of new processes that work to improve resource efficiency and/or reduce environmental impact whilst also safeguarding or enhancing food yield and quality.

For Syngenta this innovation is at the heart of what we look to achieve as a company by 'bringing plant potential to life'. In doing this we are constantly looking for ways to improve agricultural metrics and deliver sustainable outcomes in farming through the development of new pesticide active ingredients and formulations and seed breeding technologies as part of an agronomic system. The key to success is finding the balance between productivity and environmental protection.

Innovation in EU agriculture as a strategic objective

The EU believes that innovation and knowledge are key to the EU's economic growth and that all sectors should play their part. Do you agree that innovation in EU agriculture should therefore be pro-actively encouraged? Alternatively, do you see agriculture as a distinct sector faced with particular challenges to which the sector will inevitably react in an innovative manner?

Since the global food crisis in 2008, there is wide agreement on the need for increased investment in Research and Development to improve agricultural productivity, to meet the increased demand for food and other plant derived products (fuel, fiber, feed, industrial feedstocks) must also be achieved in more sustainable ways, for example by improving the efficiency of use of water and nutrients (N, P, K), and minimizing undesirable effects such as soil erosion and water contamination.

There is an important choice to be made; expand the area of agriculture land to increase gross production, or increase yields from existing agricultural land. Productivity increases through technology offer the best option to meet these challenges sustainably, since expanding arable land through deforestation results in losses of vital ecosystems and areas of high biodiversity as well as dramatically elevating greenhouse gas emissions and reducing carbon sequestration.

At the moment, however, the EU is giving out very mixed messages about what its objectives for agriculture. For example what role does the EU wish to take in trying to address the food security agenda? Does it wish for Europe to be self-sufficient, or does it wish to help the whole world to feed itself, by either developing technologies which can be used elsewhere and/or increasing European food production? The ambivalent attitude of the EU towards modern farming practices and the lack of clear objectives for agriculture are discouraging the adoption of modern technology to help deliver innovation. Examples include attitudes towards crop protection chemicals and modern crop varieties.

For the EU to have such clarity on direction is important, as all the evidence from climate change models predicts that the EU, particularly the northern areas, will continue to be well placed to farm productively, whereas in areas where availability of natural resources (especially water) are limiting, life will get harder and less predictable for farming. Feeding a population of nine billion people sustainably is possible, but not a trivial challenge.

Innovation today

How is EU agriculture innovating now? Can you explain under what conditions the agricultural sector is best placed to innovate? Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?

In recent years, political pressure in Europe regarding both the development and marketing of pesticides has led to an increasingly prohibitive regulatory environment, with particular classes of key chemicals, potentially, being removed from the market without a proper cost-benefit assessment or a clear scientific rationale. This has implications both in terms of the future development of agricultural chemicals and in terms of the tools available to farmers. This is a particularly important issue in the UK where there may be a disproportionate impact of the new rules, given the climatic conditions. The removal of key tools also limits the ability of farmers to employ innovative processes to balance production and environmental protection and compromises farmers' ability to mitigate against the onset of pest resistance.

As the committee will be aware, the political climate in Europe regarding the uptake of GM crops is also counterproductive to innovation and the development of potentially important

agricultural tools. Ten years ago the UK was a world leader in green biotechnology research and development, which was forfeited due to the adverse political environment and an inability, in Europe, to find political leadership in regard to the issue of agricultural biotechnology. Cultivation dossiers in Europe have been in the 'approvals' process for over the decade, primarily due to political opposition and the associated inertia rather than because of any inherent safety concerns. The recent approval of BASF's Amflora starch potato variety was the first approval of a GM product for cultivation in Europe for over a decade - it had taken the company thirteen years to get approval despite the technology receiving numerous positive safety assessments.

In 2004/5 Syngenta made the difficult decision to move its biotechnology R&D function out of the UK and base this work at our North Carolina facility (Syngenta Biotechnology International – SBI) in the United States, primarily due to the adverse political climate relating to the development and commercialization of the technology. Over 100 roles were moved to a site and location where the potential to exploit the resultant research work was significantly more favourable. SBI has subsequently continued to increase in size and capability and is the company's lead site for biotechnology development. The company remains focused on developing biotechnology traits to tackle global agricultural challenges but for commercial reasons this focus is primarily on developing technologies for markets where they will be approved.

Obstacles to innovation

What are the current obstacles to innovation? Is there a shortfall in research capacity and in technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their businesses?

Three of the largest agri-businesses in the world are headquartered in Europe and between them invest over \$2.5bn in Agricultural R&D. They continue to invest in R&D in Europe because of the quality of the science and scientists in Europe and the strong IP position, which helps them to recover the cost of the investments made. They also work hard to translate their technologies into the market place, in spite of the challenging political and regulatory climate. However, publicly funded Agricultural R&D has declined over the last 20-30 years, as has the public investment in agricultural extension services, which help farmers to translate new innovations into working practice. These are both areas in which the EU can help

The negative attitude towards innovation in primary foodstuffs and agriculture, as encapsulated in the "precautionary principle", has also hindered the introduction of new technologies and crop varieties into Europe.

Demographic structure of the sector

To what extent is the demographic structure of the sector (an ageing farming population) an obstacle to innovation; and, conversely, might greater innovation in agriculture serve to bring new recruits to the sector? What incentives currently exist to encourage young people to agriculture; what further efforts might be made?

The report of the public consultation run by BBSRC and the Biosciences Federation (now the Society of Biology) on Strategically Important and Vulnerable Capabilities in UK Bioscience ('niche' research skills) goes a long way towards addressing some of these concerns.

http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905_bioscience_research_skills.html

Creating a profitable farming sector would go a long way towards keeping and bringing young people into agriculture

Future challenges driving innovation forward

Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

Even though we are facing a “perfect storm” of challenges: greater food production, loss of biodiversity, water shortages and climate change, there have been many exciting advances in the science which underpins agriculture, which would address many, if not all of these problems. The key is to be able to get “more from less” by improving the efficiency and productivity of agriculture in a sustainable manner. Indeed, global adoption of the best available technology, adapted for use under local conditions could potentially treble food production tomorrow. In order for this to happen, there is a need for political leadership, development of infrastructure, education and adoption of the best available technologies by farmers all over the world. These are all areas in which the UK and EU can help

Knowledge and innovation systems

Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

A supportive environment for private company investment must be retained, but it would also be important for a revitalisation of the centres where R&D outputs can be demonstrated to farmers. Translation of practices such as new growing protocols, methods to manage field margins for environmental benefits and perhaps in the future adoption of practices that further lower the carbon footprint of farming are more likely to be taken up through practical demonstration.

Indeed there is potentially scope under the Framework Programmes, for academia, farmers and industry to collaborate to understand better the challenges faced by farmers, to develop better solutions to address the challenges faced and to provide the demonstrations and knowledge transfer support to help farmers to translate new innovations into working practice.

Research and Development

Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

Syngenta believes that the R&D effort should be leveraged through collaboration and partnership between industry, public research institutions, the research councils and government at all levels. Indeed, Syngenta already collaborates with numerous universities and private institutions (many hundreds of individual collaborations globally), e.g. in the UK with CEH (Pollinators), University of Manchester (Sensors), Imperial College (systems biology) Warwick (formulation science) and links to

Syngenta believes that the scope of research should not be restricted to “high tech” science such as molecular genetics but also applied to the more traditional areas such as plant pathology, entomology, plant physiology and field agronomy. And that focus of research in academia should be to develop a deep understanding of the critical processes controlling yield potential (e.g. hybrid vigor and stress responses), taste and nutritional qualities. It is particularly important to translate findings from model plants (like Arabidopsis) to economically important crops like wheat, barley, potato, oil seed rape or vegetables.

Syngenta strongly believe in plant biotechnology such as research into genetically modified organisms, as this offers the potential for plants with unique combinations of useful traits and marker assisted breeding as this is a critical platform technology for development of new crop varieties, with increased yield, improved taste and nutritional qualities, disease resistance and abiotic stresses, such as water, salinity and heat stress driven by climate change.

Syngenta also calls for a renewed interest in developing techniques to protect the yield potential of plants from weed competition, insect pests and fungal diseases, since at least 40% of current yield would be lost without effective pest control. Developing improved integrated pest management techniques through the judicious combination of crop protection chemicals, agronomic practices and biological control agents remains an attractive area for high productivity with reduced inputs. Management of pesticide resistance will remain a critical focus area, especially if the tools available to growers are further limited by EU legislation.

Syngenta strongly recommends a step-change in support for soil sciences, to understand better the critical interactions of plant roots with soil: understanding more about the rhizosphere, uptake of nutrients, interactions of chemicals, plants and microbial communities will allow more targeted approaches to improving plant health through crop protection and crop enhancement and provides the basis for more efficient use of fertilizers.

Public R&D focused on minor (or orphan) crops should be encouraged. As an example, many herbs or soft fruit crops are of great nutritional interest but very little research is dedicated to them as the economic potential is limited for private research. These could be useful vehicles to use the platform technologies for the benefit of European consumers, while training the next generation of commercial plant breeders and field agronomists in universities and public research institutes.

The great news is, there has never been a better time to be a plant scientist. We have unprecedented knowledge about how natural plant processes work through advances in genomics, the application of modern analytical science and modern informatics systems. We have the ability to answer questions that we could not have asked just a few short years ago.

Overall, Syngenta is recommending an integrated multidisciplinary approach including plant science, breeding techniques, plant protection, applied agronomy and precision farming to improve the nutrient, energy, water, and land use efficiency of agricultural systems while minimizing negative impacts on the environment.

Education and skills

What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

Research skills and fundamental scientific knowledge are critical to the success of the sector. Ensuring that they are relevant to the challenges facing agriculture remains a real challenge in the current environment, where science courses often fail to link with vocational priorities.

If the UK is serious about agricultural research, we need to improve significantly on the ways in which we fund and incentivise the students to pursue study in the appropriate disciplines. Given that such research underpins the integrity and reliability of the food chain as a whole, there are compelling reasons for each link in the chain to support the promotion and funding of education in this area. We would be interested in the way in which government can work to facilitate such an outcome and would welcome engagement in the process as appropriate.

Knowledge transfer

How should research be translated into technology transfer and advice to practitioners? What are the respective roles, for example, of professional advisers, professional organisations, peer groups and the public sector?

See above

In addition, the general public often have a poor understanding of modern farming practices. It would be helpful, especially as there is unfortunately an inherent distrust of companies, particularly large multinationals, in the food area, if academic and public sector scientists (e.g. from Defra and the FSA) could play a more active role in informing and reassuring the public about food safety and the value of modern technology. From their position of trust they are well placed to provide a more balanced view in the media on the real, rather than the imaginary, risks associated with food.

EU policies

What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

Syngenta believes that there is scope for the European Commission to assess, in discussions about the next EU budget, ways of creating a pillar of the CAP that links together with the objectives of the Framework Programme, in order to achieve better outcomes, e.g. improving productivity, biodiversity, and carbon footprint through innovation in agriculture. Our view is that it is critical for farmers in Europe to be involved more closely in the research and development process to ensure these desirable outcomes and the CAP mechanism provides one possible route for achieving this. The development of strong understanding and skills relating to the application of science through technology and innovative processes in agriculture will have significant benefits as we look to address the challenges of environmental protection, global population growth, and climate change.

September 2010

Oral evidence, 26 January 2011, Q 355-414

Evidence Session No. 10. Heard in Public.

Members present

Baroness Sharp of Guildford (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
Lord Giddens
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witnesses

Witnesses: **Dr Julian Little**, [Chair, Agricultural Biotechnology Council], and **Dr Mike Bushell**, [Principal Scientific Adviser, Syngenta].

Q336 The Chairman: Good morning, Dr Little and Dr Bushell. It is very good to have you here. Thank you very much for coming. My name is Baroness Sharp and I am chairing the session today because, unfortunately, Lord Carter, who is our Chairman, is unable to be here.

You have in front of you a list of the interests that have been declared by Committee Members and you should know that this is a formal evidence-taking session of the Sub-Committee and a full shorthand note is being taken. This will be put on the public record in printed form and on to the parliamentary website. You will be sent a copy of the transcript and you will be able to revise it in terms of any minor errors that have crept in.

The session is also on the record and it is being webcast so that anybody who wishes to can listen in to it. Not many people normally listen in to these sessions, but occasionally we get letters, which shows that the odd person does. So it is being webcast and will be accessible on the parliamentary website as a webcast.

I do not know whether either of you would like to start by making an initial statement, or whether you want to go straight into questions.

Dr Mike Bushell: I am happy to go straight into questions.

Q337 The Chairman: I will start. Dr Little, in your written evidence you say that the use of agricultural biotechnology can help the EU achieve economic, ecological and social goals in the coming decades. Will you expand a little on precisely what contribution you think agricultural biotechnology can make in each of these areas? Can you tell us how far you see

GM technology as a viable option for providing food security? Do you see it as integral to what is now termed sustainable intensification of farming?

Dr Bushell, when Dr Little has answered that, perhaps you could tell us how far you agree with the ABC's views on potential benefits. Given that the challenges are global, where else in the world is agricultural biotechnology being taken forward to meet these challenges?

Secondly, how much public funding do you think will be required to develop GM crops for developing countries, where the bulk of the population growth will occur?

Will you also, for the sake of the record, introduce yourselves, say who you are and where you come from?

Dr Julian Little: Thank you very much for the opportunity to give evidence today. My name is Dr Julian Little. My pay and rations come from Bayer CropScience, but I am here today as chair of the Agricultural Biotechnology Council. This is made up of six companies who are interested in the application of agricultural biotechnology to farming practices, especially here in the UK.

Your question is very pertinent and requires a little time to illustrate and answer. The first thing is to recognise that elsewhere in the world, this is an incredibly popular technology and has been taken up to a very large degree. To give you an idea of that, we are talking about 134 million hectares being grown in 2009, or, in old money, 300 million acres. If you can't get your head around 300 million acres, it is an area the size of the UK, Ireland, France, Germany and all points in-between. That is the sort of area that is currently being cultivated with a GM crop. There are also around 14 million farmers who have decided that GM is for them. That is the equivalent of all the farmers in Europe having access to this technology.

That is the sort of number currently using this technology.

Clearly, in some way or form, the technology is performing. It is delivering something—in many cases, many things—to the people who have access to it. As somebody put it to me, it is very difficult to imagine that a farmer will try out something new in their agriculture, such as biotechnology, find that it doesn't work and then carry on using it. It is testament to this technology that there is approximately 100 per cent re-uptake; once you've tried it, you like it and you carry on using it.

But you asked me three specific questions around economic benefits, environmental benefits and social benefits of the application of this technology. You will not be surprised at the economic benefit. This is a technology that allows farmers to do two main things. One is to reduce the amount of inputs, to cut the cost of producing food or materials. The second is to increase the production, or yield, of those materials. Both have quite a large impact on the profitability of agriculture. In many cases, farmers are interested in maximising their yields and in other cases, they are interested in reducing their costs as much as possible. Both are possible and it is almost a 50:50 split between those two.

From an ecological or environmental perspective, in this day and age it is critical that sustainable intensification of productive farming takes into account that we have to do all the things that we need to do and look after our environment at the same time. This technology can help in three areas. One is the simple reduction in crop spraying of things like insecticides. If you have an insect-resistant crop, it obviates the need to control insects through spraying, in many cases.

The second is the reduction in the amount of ploughing, using herbicide-tolerant crops. This has a huge impact on things like the fuel required to produce your crop. To give you an

example of that from Canada—just one crop in one country—the adoption of herbicide-tolerant oilseed rape saves 30 million litres of fuel per year in reduced ploughing. That is the equivalent of taking 10,000 to 20,000 cars off the road. So there are clear environmental benefits in that area.

The third is that a significant increase in yield can have a big impact on not ploughing up areas when you need to increase production. An increase in yields of 10 per cent, which is entirely reasonable with a GM crop, means that you can either produce 10 per cent more food, or produce the same amount of food on 9 per cent less land. Again, that is a significant environmental benefit in this day and age.

Finally, you asked about the social benefits of the technology. One thing that has been very clear from those who have looked at the technology and adopted it is the increase in the economic benefits which then feed into the surrounding economy. A vibrant farming community immediately starts to improve the viability and vibrancy of the rural economy that surrounds it. If you have poor farming, you invariably end up with a poor rural community.

Dr Mike Bushell: My name is Mike Bushell. I am the principal scientific adviser in global R&D for Syngenta, the world's largest agribusiness. I am based at Jealott's Hill research station in the UK, one of the world's biggest centres for innovation in agriculture, so I am very happy to be giving evidence to the Committee today. It is probably no surprise that I agree with everything that Julian has said. Syngenta is a member of the ABC and we have had a chance to discuss all these topics many times.

Lord Giddens: That is collusion, then.

Dr Mike Bushell: It is partnership which, of course, is critical to innovation. Julian could have talked for the whole hour, but the important thing is that GM is only one aspect of innovation in agriculture. It is, nevertheless, a very important tool and it is providing enormous benefits to farmers and to the environment in many countries. It would be nice if European farmers could eventually experience those benefits on a broader scale.

You have asked about the location for GM crops in the future. Of course, you are well aware of the success of these crops in North America and Latin America. The renaissance of the Brazilian and Argentine economies has been based on widespread adoption of this technology. That is something we should not forget. Asia is beginning to embrace these crops. A lot of public research money has gone into these crops in China, in particular, and also in India. In India, despite the problem with the regulatory process, Bt insect-tolerant brinjal is ready to be brought to the market. In China, Bt rice for stem borer control is ready to be brought to the market and those will be the first vegetable crop and the first major food crop to be GM crops.

That will be the start of the innovation process. In 20 years, rice will be a very different and much more productive crop. Those insect-tolerant traits have massive benefits in the reduction of the use of pesticides, particularly insecticides, in those two crops. These are very intensively sprayed at the moment.

In Africa there is a lot of public money in universities and other institutes going into GM research. They are bringing forward a lot of interesting varieties suitable for use in those locations. You are talking about engineering cassava to remove toxic metabolites that create problems for people who eat too much cassava at any one time. You have drought-tolerant maize and things like chick peas with insect control—again, not only getting higher yields of

important protein crops, but also protecting those crops in storage. That public money is being well spent.

You ask how much public money will be needed to bring these crops to market and this is one of the issues. The research phase of biotechnology is open to anybody to do. The challenge is that the regulatory frameworks within which GM crops are registered and traded are very onerous. That is where you almost have to have the presence of an experienced multinational company to help with the development of those traits and to help with the marketing, so that all the legal requirements in different countries can be met. This is a good example of where, in the end, public-private partnerships that benefit all the players will come together in bringing these crops forward for the benefit of the people in all the countries of the world. It may take some time in Europe.

Q338 The Earl of Caithness: You have indicated the advantages of GM, but in evidence from our next witnesses, we are told that the Sainsbury laboratory in Norwich has received £1.7 million from the BBSRC to deal with blight in potatoes, with the result of zero, whereas the Savara Research Trust, without any grants, has introduced six varieties of blight-resistant potatoes. Why are they doing so well and you are doing so badly?

Dr Mike Bushell: I'm not at the Sainsbury laboratory, but I'm sure if you ask Jonathan Jones that question he will give you a much better answer. Blight-resistant potatoes are something which you can breed naturally. However, a lot of single gene changes that happen at random during the breeding process often don't prove to be very stable in the environment. The diseases—and potato blight is a particularly aggressive disease—find ways quite quickly to overcome those single point resistances. Potatoes are an interesting crop, because it is much easier to generate genetically modified traits quickly than it is to generate a new variety by breeding. That is just a trick of the genetics, which I won't bore you with. So actually, GM in potatoes is a very good area for research.

Q339 Baroness Howarth of Breckland: I wanted to follow on your point about global partnership. In the past there has been criticism that some companies have sought to control the third world through their GM patents, rather than advance new technologies among people themselves. Is there now an answer to that?

Dr Mike Bushell: Partnerships have to benefit all parties. The best people doing research into plant breeding on a global scale are probably the CGIAR centres. They have major crop interests in cereals, in wheat, in specific crops for Africa, in rice—almost any crop; you name it. They are great at doing research, but they don't have the ability to develop a trait in the way that a company like Monsanto, Syngenta or Bayer could do. They just don't have the experience of operating in those areas. So this is a good opportunity for public-private partnerships. Then, if we talk about intellectual property, if it's a not-for-profit project such as some of the novel rice breeding programmes or the drought-tolerant maize for Africa, usually the companies are freely swapping that IP and know-how—perhaps in return for some know-how coming out of the breeding centres of the CGIAR centres. We have certainly got major collaborations with the maize and rice breeders in those areas. These are proper partnerships where we are sharing knowledge for the benefit of creating better crop varieties.

Q340 The Chairman: How far are the varieties being produced hybrid varieties, where you can't use them for seed subsequently? This is one of the big problems, isn't it, that where you've got something that has the IP on it, the farmers can't keep it back and use it as their own seedcorn. They are required to buy fresh seedcorn each year.

Dr Mike Bushell: Hybrid technology is a fantastic technology, but it does mean that you can't use farmer-saved seed. Many people would say, "Oh, that's dreadful", but actually, when you consider a hybrid maize plant, if you look at the two inbred line parents and you look at the hybrid progeny, you will see why people want to grow the hybrids. They are much more vigorous and higher-yielding, and with the high quality seed that you pay for, you get a big return on that investment.

In rice, which is mostly farmer-saved seed across the whole of Asia, the yields are quite low in many areas. There's a big variation in yields. If you look at the average yield across Asia, it's about four tonnes per hectare. If you look into China, the average yield is about six and a half tonnes per hectare, and this is the result of the fact that about 50 or 60 per cent of their acreage is under hybrid rice, and that is the yield boost that you get through hybrid vigour, so it's worth buying that new seed each year.

I'd also say that for rice, the biggest problems that farmers have are weeds. A lot of farmer-saved seed, after two or three years of growing in a relatively poor environment, is riddled with things like weedy rice that not only rob your yields because you are growing weeds; the rice varieties that have coloured or shattered grains or taste bad lower the price that farmers can ultimately get for that rice. Farmer-saved seed is a right, but it isn't always the best thing to do.

Dr Julian Little: A good example of that is in India, with vegetables. It used to be traditional that you would grow your vegetables and save a portion of your vegetable seed for the following year. Over the last 10 years, we have seen a wholesale shift towards hybrid vegetables—invariably, with Indian scientists doing the work and bringing varieties to the market that people want. What is fascinating about that is that once you start buying that hybrid seed and getting the benefit that we have heard about there is a huge re-uptake on that. Farmers are very happy with investing in really high-quality seed, because they recognise the benefits that they get out of it. That is not GM; it is hybrid. Whether you bring a GM hybrid to the market does not make a difference for these people. What they want is high-quality seed that can make a difference to them.

Dr Mike Bushell: Any of you who have gardens will understand the benefits of F1 hybrids, particularly if you're growing something like pansies.

Q341 The Earl of Arran: In India and China, was there initially the same public scepticism about GM?

Dr Mike Bushell: China is an interesting example, because until the last five-year science plan, agricultural technology has been the number one area for investment. This is obvious in a country with 1.3 billion people. Food security has been at the top of their agenda for all of this time, so they have made a fantastic investment. They have a pyramid of talent and knowledge that is second to none. This has resulted in a lot of advances and higher-than-average yields across the whole of Asia being achieved by Chinese investment.

Q342 The Earl of Arran: So they just went ahead and did it, did they?

Dr Mike Bushell: There is an advantage to having a Government that can do stuff. In India, of course, it's a different political environment; but again, because of the urgent need to provide food security—until recently anyway—there has pretty much been a more favourable view to anything that would help the lot of smallholder farmers.

Q343 The Earl of Arran: And they've got to feed 1.2 billion people.

Dr Mike Bushell: Well, the Indian population is growing much more rapidly, and eventually, in the near future, it will overtake the Chinese population.

Q344 Lord Giddens: Good morning. Thank you very much for coming here. You introduced yourselves and I will introduce myself. I am Tony Giddens. I used to be the director of the LSE. I am a social scientist. Before I start my two formal questions, it is unknown, in my experience, to find any major innovation that does not have a downside. Where are the downsides?

Dr Julian Little: For biotechnology?

Lord Giddens: In terms of biotechnology generally and, specifically, GM crops in particular contexts. There must be some. Are there no worries, downsides or secondary consequences? Is the stuff about big business dominating local farmers just a myth?

Dr Julian Little: It is interesting that these ideas that there are issues have grown up. What is interesting is that many of these products were designed to increase yield and/or to reduce production costs. The thinking of the technology providers was that we can help farmers solve some of their problems. What is fascinating is that, from a farmer's perspective, once they started using this technology, they found what they would describe as unintended consequences. You would grow a herbicide-tolerant crop in a way that means that you do not have to plough. In a farmer's mind—or certainly in a tech-provider's mind—when we set out, we did not think that this was a technology that will allow you to stop ploughing and to accrue all the benefits in terms of soil and moisture increases or less of a dustbowl mentality. All of these were seen as unintended consequences, if you like. Are they negative? No. I would guess not.

Likewise, there have been unintended consequences with insect-resistant crops—for example cotton or maize—but to my knowledge most of those have been very positive. Again, I will give you an example. Spanish maize has traditionally had some problems with infections of fusarium causing mycotoxin accumulation. Most of those infections come through insect damage. An insect will attack the maize and you will get infections through that source. Yet, once they started growing insect-resistant maize, they suddenly noticed that they were getting close to zero mycotoxin infection. Again, it was never promoted as a way of improving the food or feed quality of that maize. It was unintended in that sense. But it has proved to be quite a reason to adopt.

Q345 Lord Giddens: I take both points, but is there no downside?

Dr Julian Little: Maybe you have the view...

Lord Giddens: I am only asking. I don't have a hidden agenda or anything. I have just never heard of any major innovation in the history of the world that had no downsides.

Dr Mike Bushell: First, it is perfectly possible, through GM technology, to make crops that would be horribly toxic. You could build in new metabolic pathways creating toxic materials that had a brilliant plant-protecting effect. But of course that would not be something which anyone would want to do. That is something that the regulatory processes would stop from happening anyway. The result of all of the GM crops that have come before the European food safety authorities has always been the same. These crops are as safe to grow and to eat as any other crop. They are not safer; they are as safe. The biggest unintended consequences of intensive agriculture are in other parts of the system. The challenge for sustainable intensification is to look at the whole aspect of that system—which I am sure that we will

come to on subsequent questions—and to minimise those negative outcomes, while maximising those things that you want from farming. Gene flow is one of these.

Q346 Lord Giddens: I must move on to the questions that I was down to ask, one of which is how GM technology links with other innovations. You say that it happens within a context of wider systems and innovations. It would be good to have some examples of that.

Dr Mike Bushell: Again, if we think about a system and look at where GM crops are grown and look at the environmental footprint of maize and soya in North America, you will find, in the last 20 years, a very substantial reduction in irrigation water use per unit of output and a massive saving in soil loss; you will see energy use on the farm reduced; you will see a lot of particular benefits in protecting water courses from pollution from run-off. These are almost all because the simple way of growing the crop, with a simple, cheap, effective herbicide regime over the top, has allowed a much greater take up of no-till and minimum-till systems. That is a dramatic increase in yield and water-use, and nitrogen-use, efficiency. They are all benefits that have come because of those GM crop-based systems. You can grow traditional maize in no-till as well. It is not entirely to do with the GM crop but it is to do with adopting those positive practices. Margin management is another one.

Q347 Lord Giddens: Forgive me for interrupting but that is more about the knock-on consequences rather than about other innovations that are needed, for example, to manage the consequences of introducing GM crops. You mention modern management techniques, for example. We are trying to deal with innovation in a very broad context, not just in a technological one. It would be interesting to hear what you have to say about other innovations that might surround these more technological ones.

Dr Mike Bushell: Look at what a farmer has to do. He has his field and his agronomic knowledge of the crop that he has chosen to grow. He has basically four technologies that he can apply to create the sort of crop that he wants. Those technologies are the same as what has delivered the fantastic benefits of the green revolution. It is mechanisation, including irrigation. It is new seed varieties. It is crop protection chemicals to control weeds, pests and diseases and it is fertilisers. Innovations in all of those areas can have a big impact on the new drivers that we have behind agriculture for the future.

Let us talk about the whole issue of water. Sustainable intensification is a lot about making the best use of scarce natural resources. If we want a more water-use efficient crop, we want more productivity—more crop per drop, should I say? We can develop, and have developed, drought-tolerant hybrid maize. We have just launched the first variety in the USA this year. That is one way of doing it. If you look at a cropping system using growth regulators in wheat—using one of our products—you can get a water-use efficiency increase of 35 per cent. That is a higher yield, with 10% less water needed for irrigation. If you use crop enhancement chemicals that boost the vigour of the root system of a crop, those crops are much more able to look after themselves in dry conditions because their roots systems are deeper. They also forage for nutrients in the soil much more effectively, increasing both water and nutrient uptake efficiency and that is before the farmer has even started thinking about how he grows the crop and irrigates it. Some crops use drip irrigation, which is a fantastic way of improving both the water and the nutrient-use efficiency. All these things together can be built into very efficient systems but, of course, these things need to be demonstrated to the farmers and they need to be economically suitable for the conditions in which his field exists.

Q348 Baroness Howarth of Breckland: I have a very quick question for the record—none of us have an agenda; we need to ask you questions for the record. There has been some question about the effect on biodiversity. Is there any research in the States available that tells us whether there is a positive or negative effect?

Dr Mike Bushell: The issues on biodiversity are very simple to me, which probably means that they are not. There are two ways in which modern agriculture can benefit biodiversity. The first is by growing a very high-yielding crop, making best use of the arable land that we are farming on at the moment. We can protect land elsewhere and keep our best areas of biodiversity intact. Biodiversity loss is almost always about the loss of habitat. So, if you chop up an acre of rainforest or you plough up an acre of permanent grassland, you have done irreparable damage to the communities of organisms that were inhabiting those areas and you will find less biodiversity in the centre of the field when you are growing a crop on them. There are two things: save land and keep it in permanent set aside, preferably, in areas of high biodiversity like mixed woodland or tropical rainforest. Secondly, you can benefit diversity enormously by managing your margins for high biodiversity. We have 10 years of experience with programmes to encourage pollinators by planting your field margins with high biodiversity-rich areas with wild flower mixes or pollen and nectar mixes, which dramatically increase the number of insects and pollinating insects, and the number of birds and rodents that feed on those.

Dr Julian Little: To follow up on that, it is always worth remembering that when you look at a field in the UK landscape, 90 per cent of your biodiversity will be held within a few metres of the hedge around that field. The middle of that field has a very low biodiversity and has been managed for that precise thing, which is, “I want my crop of wheat or oilseed rape with little else in there”. Doubling your biodiversity in the middle of the field has very little impact on your overall biodiversity. If you are serious about wanting biodiversity in your landscape, you need to double the amount in the margin because that is where you will make the difference. Our view with sustainable intensification has always been that we need to increase the productivity of the middle of that field, which will give us the opportunity of doing more at the edge of those fields.

Q349 Baroness Parminter: In the Foresight Report, which was published earlier in the week, they made it clear that the global food challenges will need to be met by more than one system of food production. Given the challenges in the States at the moment, how do you see GM production coexisting with organic farming in the same country?

Dr Julian Little: The way that you deal with these things—this is what they would describe as a coexistence issue—is all about putting in the framework that allows these different ways of farming to exist, whether they are organic or what some people describe as conventional or GM. In the US, they have very big areas of organic production and very big areas of GM production. Overall, the US is probably the biggest producer of GM, but it is also the biggest producer of organic food. Clearly they have mechanisms to do that. In Europe, these things have to be a bit more formal and you will be aware that there is an industry group called SCIMAC that was essentially put together to try and determine what is the best way of allowing coexistence to happen in the UK. That group is made up of representatives of NFU, the supply chain, AIC, the technology providers, and also the plant breeders. We have brought forward some very reasonable proposals to achieve that. And, of course, we have experience growing GM in this country. Extensive field trials were carried out in the 90s and early 2000s. Those were carried out without one incident in terms of organic accreditation. We have very high confidence levels that this is not only possible, but achievable without an unreasonable regulatory framework.

Dr Mike Bushell: I would add one rider to that. The regulatory frameworks require full risk assessments on these topics. So you can't ignore those questions. They absolutely have to be addressed through the regulatory framework.

Q350 The Earl of Caithness: Both of you are critical of the EU and its policies. Dr Bushell, you said that it is hampering the delivery of innovation. Could you say some more about how you would like EU policies to change and how that can be operated through CAP to the fairness of all? Dr Little, you were also critical of the dysfunctional regulatory system. How would you improve that to make it not only fairer, but also equally democratic?

Dr Mike Bushell: You need to consider the total policy environment. When you talk about the CAP, you have to put that in context of the whole overarching strategy for innovation and economic growth in Europe. You have to also think about the investments going to be made into research through Framework 8 and, of course, because CAP and Framework 8 will be being developed, plans will be being developed at the same time, and it's helpful to be able to put them together. As you have asked Julian, you also need a regulatory framework that is not just about stopping things happening. In fact there needs to be a question, perhaps, to regulatory frameworks and people operating within them asking how this regulation is benefiting the outcomes that we want from agriculture and how it is encouraging innovation in order to get better outcomes. That's the sort of view that someone like Joyce Tait from the Innogen Centre at Edinburgh University promotes very strongly. You asked about CAP, we said in our evidence that for years there had been mixed messages from what we wanted from agriculture. In view of the Foresight Report, which has been mentioned already, there is a great opportunity for us to say that this seminal report—the best evidence and the best research document on future food security—should be a framework that the CAP and Framework 8 should use to set the direction; making sure that the research agenda in Europe, the regulatory framework, the incentives for land use and the payment for farmers for desired outcomes are all pointing in the same direction and the outcomes that we want are about sustainable intensification; highly productive agriculture that is economically sustainable for farmers across Europe, because they are the stewards of the land. The biodiversity and environmental benefits that we want are also going to be in there, in Pillar II. I'd also like to see payments in Pillar II reflecting the work that farmers have to put in to develop even higher areas of biodiversity and better outcomes.

Dr Julian Little: It's worth reflecting on where this legislation came from and perhaps reflecting on the fact that the EU is always a little behind the times when it comes to legislation. When technology providers came to the market with new products that reduced costs and allowed you to produce more food, it was at a time in Europe where all the legislation going through the books was a distinct attempt to reduce production in Europe. Not surprisingly, it was very easy for quite draconian legislation, limiting the exploitation of this technology, to get on the books pretty quickly. Elsewhere in the world, there wasn't the issue of overproduction. In many countries, such as in South America, there was a drive to make agriculture a great export market and a way of developing their economies. We are now in a situation where in some ways the overall policies of the EU to reduce productivity have to be reversed. We have seen a number of aspects where there is an apparent desire to produce more food in Europe and yet we have seen increasing new legislation in the area of accessing pesticides and the use of pesticides which are completely strange to the rest of the world. We are still in this environment where we have a two-tier system of regulating GM. We have the science bit, where you have to do all the work to demonstrate that the product is at least as safe as its non-GM counterpart. Then you have a

political bit that says, “Are we happy with that?” Within Europe, there are some countries that are more forward-thinking, which recognise the issues of food security, recognise the need for that sustainable intensification, and there are other countries which essentially rely on European money to keep farmers on the land and see absolutely no benefit for Europe to become more productive. Not surprisingly, within our regulatory system we relatively quickly get to the stage of saying that the product is safe, but we get nowhere on the political aspect. When it comes to new technologies that can significantly improve the ability to do agriculture, Europe is very much at odds with the rest of the world. One of the things that came out of the Foresight Report is that on climate change, Europe is in a position to be far more responsible for food production than it has in the past. Europe is going to be affected less by climate change, at least on the more optimistic prospects, than most places in the world. So there is in many cases a very high imperative for us to get our act together when it comes to food production. Translating that into more fair more equitable legislation in Europe, I am afraid, still looks a long way off.

Q351 The Earl of Caithness: I would counter your argument by saying that we are mere politicians who reflect what the public want. If the public don’t like GM because they were sold it badly by scientists in the first place, it is up to the science side to get their act together and say that this is not only safe but healthy.

Dr Julian Little: Yes, it is interesting. The idea of public perception—or perception of public perception—is one of those strange areas of social science. It is very clear from more recent surveys that consumers, including those in the UK, have moved significantly on their view of GM over time. Undoubtedly, food inflation and food security issues have caused some of that movement. I am not convinced that European politicians have moved as fast as the public view.

Q352 Baroness Howarth of Breckland: Lord Caithness has asked my question, but we don’t mind that here. I would like to follow up and complete the question about public attitudes. Dr Bushell, you mentioned that there is an unfortunate inherent distrust of companies—large multinationals—in this food area. We have talked a little bit about that earlier. We are quite interested in who should be responsible for helping the public to gain a proper understanding of agricultural technology, because it is clear that that understanding and that conveying of intelligence is not there. Do you think the public can be encouraged towards a more positive attitude, despite this mistrust? And do you think multinational brand food supermarkets which do enjoy consumer trust could improve the image of GM crops internationally? The only other point I want to make in clearing it all up is that you talk about a cacophony of interests—don’t people have a right to their view and to make their view?

Dr Mike Bushell: Did I say a cacophony?

Dr Julian Little: That might have been mine.

Dr Mike Bushell: That is one of the things we don’t agree on. Everyone is entitled to their views. How people make up their mind is of course a very important area of social science. If we start with the supermarkets, it is very important that they understand the technology that is benefiting them in bringing safe, healthy, affordable food to consumers and that they are able to answer those questions that the public have. Syngenta is a business-to-business operation. We are operating further back in the chain, but it is important that we have a dialogue with all of the actors in the food supply chain—retailers, food producers, processors, logistics companies—so that all of us together understand what technology is in

the food and how that reflects in terms of overall public safety. We have to find more convincing ways of talking to people—not lecturing them and not going into high science that makes everyone switch off in 30 seconds. We have to have some joined-up dialogue and that means listening and talking.

Q353 Baroness Howarth of Breckland: Who is working on that and how is it being moved forward? Public attitudes may have moved to some extent. It is one thing to say that the Food Standards Agency should influence thinking, but the Food Standards Agency has been saying that GM food is safe for the last 10 years. They may have moved it a little, but who should really be taking this forward?

Dr Mike Bushell: Everyone should. That is where you have to have a debate between all the stakeholders. Politicians absolutely do have a responsibility to know that what you're accepting through regulatory frameworks is leading to safe food. You also, as politicians, have an amazing opportunity to shed light on the real risks associated with food, and not the imaginary ones. There are many people who worry incessantly about things that will never happen, while ignoring much bigger problems. If I was to create a food risk table—I don't know if we will have time to go into it now—pesticide residues and GM crops would be right down at the bottom. Above that, would be not having enough food—one billion people. Not having enough micronutrients-rich food—another billion people. Eating too much—another billion people. Then you are going down to mycotoxins and with microbial contamination—500 people die each year in the UK from food poisoning – and choking to death, 150 people. You actually go a long way down the risk league table before people start to think about things that, to a degree, are extremely well controlled by the regulatory processes that actually allow them to be used. Everyone needs to do this. Unfortunately, politicians and industry people are right down at the bottom of the trust-league table; scientists are up at the top. Professor Beddington's network of independent scientific advisers at the heart of Government in the UK is a fantastic network for making sure that politicians and the public are well-informed with independent views. That's something we could do with a lot more of in Europe.

The Chairman: We need to move on.

Q354 The Earl of Arran: On the all-important subject of research; Dr Bushell, you take one page on your views and you call for an integrated multi-disciplinary approach to R&D. How far away from this vision is the research currently supported by the BBSRC, Defra, and also the EU? And of what additional help might leveraging through collaboration be?

Dr Mike Bushell: In the UK, the food price crisis of 2008 was a real wake-up call. The Government answered the call by putting in place a lot of important actions. If you take the BBSRC, there is a lot more going right with them than is going wrong. For example, they have a fantastic research strategy that is now rebadged. It has got bio-science for food security right in the heart of it. This is positive, because it drives a lot of their funding decisions to put that work in areas that will have some value to the country. If you look at the centres that they support in systems biology, which is of course taking a complete look across a biological system; it could be at the level of a cell; it could be at the level of a whole organ, like a plant root; it could be at the level of a field, or even a planet, if you are talking about climate change. Those systems biology approaches are central to multi-disciplinary research, because they provide the understanding and the ability to predict based on that understanding to do better research for the future. The BBSRC institutes are great places to demonstrate practical application of this technology when it comes to agriculture. Because I am on the strategy panel for the BBSRC for sustainable agriculture, having reviewed all of

the institute programme grants and the research director's strategies, I can say that they are all going in the right direction. That is not necessarily true across Europe, although there are great examples of institutes doing good work. The Technology Strategy Board is another important advance. It is designed to fill the gap between the great early stage fundamental research that we have always prided ourselves on in the UK and the application of that knowledge into real world problems. The TSB is doing a good job at plugging that gap in the middle.

Q355 The Earl of Arran: Dr Little, do you see no scope for leveraging? There is quite a powerful disincentive to do so.

Dr Julian Little: Maybe I need clarity on that question.

The Earl of Arran: You say that because of “political interference and a moribund approvals process, there is a powerful disincentive for abc member companies to invest in future development or to enter into meaningful partnerships with Member State governments”. Do you therefore see no scope for leveraging?

Dr Julian Little: The issue is that we are all global companies. We are working very hard for our shareholders to make sure there is value for what we do. We have some choices. We can develop new products for places such as South America or south-east Asia, where agriculture is seen as something worth investing in by Governments, and the market is ever-increasing with population change and everything else. Or we can invest in Europe, where we have no idea whether our products will ever be allowed to get to market.

I will give you an example of that. Last year, one of our member companies, BASF, managed to get a new GM crop for cultivation into Europe. That was the first time that had happened in 13 years; 13 years on a long research programme is not huge, but you certainly don't want to invest in products for Europe if you believe that it is going to be another 13 years before the next one is going to be allowed in. It makes it very difficult for us to say, “It is definitely worth investing in Europe because we know that that investment will see products that will be useful for farmers”. If it gets stuck in the European system, that is no help to anybody, whereas we can go to South America, North America or south-east Asia where they are desperate for solutions to their problems. We know that we have the capacity to bring those solutions to the market; we know who we will be dealing with in terms of partnerships with either groups or Governments; and we know that those products will get to the market because there is a method for getting them there.

Q356 The Chairman: Can I take you up on this issue of having the capacity? Part of that capacity is the research capacity, which is the key issue here. In the UK, in places like John Innes, we have had foremost plant biotechnology expertise. Dr Bushell spoke very positively about the programmes that the BBSRC have been funding. The question is whether we retain that expertise in Britain—for example, developing products that can be used in other parts of the world. They do not necessarily have to be used in the UK, just as in the pharmaceutical industry we have been a centre of research for that industry which has been used worldwide. The key question is whether the UK expertise is being adversely affected by the regulatory framework in Europe, meaning that we cannot take the products to market in Europe.

Dr Julian Little: I think it is. We saw quite a big exodus of expertise—Syngenta is a good example of that—where scientists just saw no point in doing research that was not going to get them very far. For example, if they wanted to do field trials in the UK, chances were that those fields would be trashed, with no meaningful information coming out of there. It

certainly did have an impact, but I feel that over the last few years a lot more confidence has come back in. Mike has given a good explanation of the way the Government has tried to reinvigorate this research. The UK has always had a justifiably proud tradition in some great fundamental research. It is very difficult for this research to be translated into products, but it certainly is not impossible, and companies will undoubtedly work with these institutes to see how best the great knowledge being produced can be exploited.

Dr Mike Bushell: May I just add one other point? On an international perspective, DfID has a very laudable strategy to help address a lot of the issues associated with the millennium development goals. Inevitably, a lot of those issues come back to smallholder, subsistence farmers. For years, the international community took its eye off the goal that should have been promoted in those areas, which was to raise the economic lot of those farmers. Poverty is the root cause of almost all their issues. DfID is now taking a much more active approach and is therefore a good vehicle for the knowledge transfer network, making use of the expertise developed at Rothamsted—and there are great projects there such as field work in Kenya and other parts of East Africa. These are things that have a dramatic impact on individual people's lives, provided they can be demonstrated to them in a way that is meaningful in their environment.

Q357 The Chairman: I fear we have run out of time and we are not going to be able to cover the final issue that we wanted to cover, which is extension services. I wonder if you could send us in writing any comments that you might have on that issue. If you have any other issues you would like to come back on and provide us with more information, that would also be very helpful.

Dr Mike Bushell: I would definitely be delighted on that one. I spoke recently at a meeting on my big idea for food security. I asked all my colleagues what would be a big idea, and the best one of all was from the head of our African business, and it was that every village should have a demonstration farm. That would go a long way to addressing a lot of these issues.

The Chairman: Thank you very much indeed. This has been an extremely useful evidence session for us; thank you for coming.

Examination of Witnesses

Witnesses: **Emma Hockridge**, [Soil Association], and **Pete Riley**, [Campaign Director, GM Freeze].

Q358 The Chairman: Good afternoon, Mr Riley and Ms Hockridge. I apologise for running over a little bit. We had hoped to start about noon. We shall obviously run on a little bit later. I don't need to introduce myself, since you were sitting in on that session. Do either of you wish to make a statement or shall we go straight into questions?

Pete Riley: We are happy to go straight into questions, given the time.

The Chairman: When you answer your first question, introduce yourselves briefly for the record. Lord Giddens has the first set of questions.

Q359 Lord Giddens: I welcome you this morning. At least one of you has been here through all of the previous session; it will be interesting to contrast your comments with those. I apologise because I have to leave at 12.30pm. I am not leaving because I am disgusted with what you say.

I start by asking Mr Riley for his views on food security. Everyone knows that it is an intensifying issue. How would you propose to set about a strategy, both in a European context and perhaps more widely, to deal with, or, at least, to make an approach to, that issue?

Pete Riley: It is certainly going to be a major issue across the world in the next 50 years. Sorry, I should say that my name is Pete Riley and I am the campaign director of GM Freeze, which is an alliance of organisations that would like to see a moratorium on developments in GM crops until certain key questions on the science and socioeconomics have been answered.

The question of food security is massive and has many facets. It has as much to do with social, economic, political and trade issues as it has to do with science. As the previous speakers finished off saying, poverty is absolutely at the core of how we tackle food security not only in the global south but also for poor communities in the north as well.

Q360 Lord Giddens: Since many of our witnesses have stressed that GM crops will be crucial to intensifying yield and that this is necessary for coping with issues of food security, how would your alternative approach deal with that?

Pete Riley: The first thing to look at is whether GM crops have achieved any increases in yield to date. As you will be familiar, a large report came out about two and half years ago, *International Assessment of Agricultural Knowledge, Science and Technology for Development*. They asked for independent evidence that GM crops had increased yield and they didn't find anything to support that. This is probably explained by the fact that all the GM crops growing in the world at the moment have just one trait—either for herbicide tolerance or insect resistance. The yield from the genetics of the crop comes from the whole plant and not just the single gene. So, there is no guarantee that, putting one GM trait in, you'll get an increase in yield because it is how the whole genome of the plant reacts to the environment, rather than one gene, that's important.

We aren't convinced that GM will be the answer to increasing yields. We think that the answer to increasing yields is to manage farming systems much better. The core of that is to make sure that we begin to manage the soil in a way that it is stable, can hold moisture better, and nutrients, and can enable plants to access nutrients because there's a rich microflora in the soil. The core of it is agroecology. We need to change our thinking about agriculture towards agroecology because the present system is far too dependent on non-renewable resources or resources that will become very expensive—principally oil and phosphates.

Q361 Lord Giddens: Would you be able to define agroecological farming, since it's such an important part of what you say?

Pete Riley: Yes, it is getting the farming as close to the natural ecosystems as you can manage. One is working in collaboration with naturally occurring organisms to create the sort of environment that allows crop plants to thrive but also to develop new types of crop plants. For instance, there are the perennial crops plants that produce trees, which could produce protein crops in the form of nuts that would be much deeper rooting and therefore accessing water from far deeper in the soil than annual crops. We need to start thinking about how we design our farms in a way that we can harness all the attributes of the soil and the local environment to maximise yields. We believe that that requires a sea change in thinking in terms of research.

Q362 Lord Giddens: Would either of you be able to provide an example of a specific form of best practice that you had in mind that would show that you can dramatically increase yield or produce other benefits that would be relevant to food security, either from a European or global context?

Emma Hockridge: I am Emma Hockridge, head of policy at the Soil Association. We are a membership charity which promotes organic and sustainable food and farming systems. That is an interesting question. Certainly, organic agriculture is one example of an agroecological system. There have been many very interesting projects, particularly in African countries, which have looked at ways of producing multiple crops within a single farm system, which has had huge benefits and compares quite starkly with classic GM monocultural systems in very large scale farms, for example, in the US, which are completely unsuitable for smallholder systems. The very diverse systems enable a huge range of crops that improve micronutrient levels and can have a huge range of benefits.

Q363 Lord Giddens: Do you think these two kinds of systems can exist alongside one another or are they mutually incompatible?

Emma Hockridge: I think they are mutually incompatible. It was interesting that the previous two speakers mentioned the idea of co-existence—for example, whether organic farming could exist alongside GM monocultural production. There has been an interesting example recently of an Australian farmer who has lost his organic certification as a result of GM contamination from a neighbouring farm. This is something that the GM industry told us could never happen—"It's not going to ever be a problem". Now, the examples are beginning to come through that show that we cannot have the two systems working side by side.

Pete Riley: In Canada, the organic canola oilseed rape production has basically ceased as a result of the introduction of GM oilseed rape or canola because of contamination issues. It is impossible to keep pollen from spreading from crop to crop.

Q364 Lord Cameron of Dillington: Mr Riley, you were saying that GM hasn't produced any yield increases. How do you respond to the previous speakers' intimations that it does reduce inputs, either chemical inputs, which might be of interest to the Soil Association, or fuel, as he was talking about in Canada?

Pete Riley: The first point to make, which the previous speakers alluded to, is that zero-tillage technologies are not exclusive to GM, in fact they pre-date GM by a decade and a half, so this is not an exclusive GM technology. If you look at inputs, this is where it gets very interesting, because for herbicide-tolerant crops in both South and North America, where the main trait is resistance to Roundup, or glyphosate, there are now serious problems as a result of overuse of that herbicide creating weeds that are resistant to Roundup, or glyphosate. We see it covering all the major GM crops—maize, soya and cotton—in the USA, to the point that in the cotton belt they are now employing labour to pull up these weeds by hand because they haven't got the capacity to deal with them in any other way. There is a memorable clip that I found on the internet of a weed scientist saying that a particular weed, Palmer amaranth, if we let it germinate in cotton, we have no means of controlling it because of this resistance build-up.

As a result, although the initial impact of GM herbicide crops was for herbicide usage to go down, it is now climbing steeply and this has been very closely linked to the overuse of glyphosate on the crops. As a result, we are now seeing companies such as Monsanto teaming up with other companies that manufacture agrochemicals to sell packages of herbicides. So instead of one herbicide being used on a crop, we may see three or four different ones at different stages to try and keep a lid on these weeds which are resistant to glyphosate, which have the capacity to spread and which have spread quite rapidly.

Q365 Lord Cameron of Dillington: What about the use of GM to enable plants such as maize to be grown in dryer conditions where they could not previously be grown?

Pete Riley: To my knowledge, there is no commercial GM drought-tolerant maize available at the moment. They are in production, but there are also drought-tolerant non-GM maizes produced by conventional breeding already available. I will go back to my earlier point. A plant will thrive in an environment as a result of its total genetic base rather than single gene changes. There is no guarantee that switching one gene, which may help with drought resistance, will result in a variety that will thrive in extreme conditions. In such extreme conditions as no rain, neither GM nor non-GM crops will germinate. I have personal experience of planting a seed in the ground and it not appearing for an awfully long time because the soil was bone dry; that was in the UK.

Q366 Lord Cameron of Dillington: All that GM maize does is silence the gene that makes the cob abort, which is what happens in drought conditions. It makes the plant grow smaller, because maize is a very big plant.

Emma Hockridge: To add to that, the system in which a plant is grown is vital. In particular, organic crops, because they are slightly lacking in certain nutrients—fertiliser is not applied—they scavenge further and the root systems have been proven to be much bigger as a result. Therefore, as well as scavenging for nutrients, they also scavenge for water and have a much more complex root system which enables them to be drought-tolerant and to work well in developing countries.

Q367 Baroness Parminter: The food challenge that we face is global and food markets are global. In other parts of the world they are prepared to accept GM. How do you see the

future for the competitiveness of EU agriculture if the EU maintains its present position on GM?

Emma Hockridge: In terms of competitiveness, it has been interesting to note the stance of other EU countries, which have listened to their consumers and focused on producing high-quality products. They have come to realise that, perhaps because of the scale of the EU, we won't be able to compete in purely industrial crops on a very large scale, just looking at the sheer size of other continents producing industrial level crops. So we have to look at competitiveness in the round, in terms of whether there are particular interesting niches, such as providing quality products, which might be more appropriate for the EU.

Q368 The Chairman: As a group we were quite impressed by the evidence we received in a conference call with the United States. They were instancing the fact that agricultural productivity in both North and South America has been increasing by approximately 4 per cent per year, whereas European agriculture, for the past decade or so, has stood still and productivity has not increased at all. They attributed this very largely to the adoption of GM crops. How would you counter that?

Pete Riley: The counter is that many farmers in North America who have used herbicide-tolerant crops and we have seen interviewed on film would dearly love to have access to non-GM seeds again, because the costs and complexities of managing GM with resistant weeds is becoming a real problem for them. The productivity of the crops is in doubt now because of the failure of the technology to overcome the fundamental problem of weed resistance. I don't know what the basis of the claims is. In South America, some of the soils may be quite nutrient-poor, so if they have been using artificial fertilisers to boost productivity, I do not know whether we can separate out the GM component from the general intensification of arable production in South America. Without looking at the data on which the claim is based, I wouldn't like to pass comment.

There is certainly good evidence from Africa, where a UN and UNCTAD report looking at the productivity of organic agriculture systems in Africa, published two years ago, found that where it is applied consistently, they were getting up to double yields. There is conflicting data on all sides and this is where politicians have a difficulty in working out where the data comes from and who produces it. Some independent assessment is needed. That is what we got from the international assessment report. They were independent, they assessed the performance of GM crops and the performance of agro-ecological approaches and they said that we need to invest far more in agro-ecological approaches than we have hitherto.

The Chairman: These were OECD statistics, looking at agricultural production over the course of a period of years.

Q369 Lord Giddens: Before I go, I was wondering whether you could send us details of the evidence that you are quoting, or references to it. It is quite unusual, in my experience, to find such a radical division of views, where there must be quite a lot of evidence around about the consequences of GM crops. If we are going to reach an informed view, it would be useful to have some of the evidence that you are quoting to compare with the evidence that others are quoting. When you have people who are so gung-ho on one side and the division of opinion is so significant, it would be really useful if you could send us some material to scrutinise.

Emma Hockridge: Absolutely. I'd be happy to.

Lord Giddens: As far as possible, we have to be scientific.

Q370 Baroness Howarth of Breckland: I want to move on to the demographic and social aspects and talk about the innovation question. Mr Riley, in the summary of your written evidence, you stressed the need “to encourage young farm entrants into farming through the creative use of the rural development fund.” You link this to the development of community-supported agriculture. Can you say more about this? Are there examples of the use of the EU rural development funding to support these approaches—real and living examples? Perhaps you could say whether you have any other views on that issue.

Pete Riley: Certainly, in other European countries the rural development fund has been used to encourage young entrants into agriculture because of the recognition of the aging of farmers and people who are engaged in farming. There is plenty of evidence, mostly in eastern EU countries, but increasingly in France and Germany as well, where they have begun to spend money to try to address that imbalance in the age profile of farming.

In this country, there are no examples that I know of rural development money being specifically targeted on getting young people into farming, but there are a number of very good examples of communities getting together and beginning to support their local farming communities—in what’s known as community-supported agriculture (CSA)—to further their supply of the sort of food they want and to support the continuation of people working in food production in their area. Emma will be able to give examples of this; the biggest one is in Stroud, where about 250 members of the CSA are supporting the production of food. The numbers are growing all the time, as people see it as a way of reconnecting themselves with agricultural food production, but also a way of supporting the rural economy and supplying themselves with the sort of food that they want.

Q371 Baroness Howarth of Breckland: Can you give us more specific examples?

Emma Hockridge: Certainly. At the Soil Association we have a large national project working to help farmers who want to set up community supported agriculture projects on their own farms to do so, and this has been popular. Pete has mentioned a few examples. They are spread all over the country and work in quite different ways, often involving vegetable production. Part of the aim is to get those local communities out onto the farms. The Soil Association also has an apprenticeship scheme; we have noted that there is a huge amount of interest from young people in getting involved in agriculture, yet often there aren’t the opportunities for training and access to land. So this apprenticeship scheme has been running for a few years and is very popular. This is something close to my heart: I am a young farmer myself. My family farms in Devon and I am actively involved.

We found some Defra research showing that within organic agricultural systems there are much higher levels of women farmers and young farmers as well. That seems to be down to the more varied jobs available in organic farming. People are keen to become involved. At the moment, it is not funded through the rural development scheme; it is through foundations and trusts for the CSA and the apprenticeship scheme, but it would be useful if it could be funded in that way.

Q372 Baroness Howarth of Breckland: Most farmers have another job these days, in order to sustain their living—or many do. In the kind of project that you were just describing, is that true of those people who are involved? How sustainable is that model in terms of size and productivity, bearing in mind the crisis we are going to face in terms of food production?

Emma Hockridge: Often the farms that we work with would use the community-supported agriculture almost as a diversification scheme, so it would in some ways become their extra

role, alongside the normal function of the farm. That is relatively common. In terms of the output of food, particularly by using voluntary labour and being relatively intensive in producing vegetables on small areas of land using the holistic organic system, they have been very effective in producing large volumes of food for their local communities.

Q373 The Earl of Caithness: I would like to move on to getting advice to farmers, sometimes known as extension services. Do you think that British agriculture has suffered as a result of the old ADAS having changed? In the past, farmers got impartial advice and now they get advice from a vested interest's point of view. First, do you think that farming in the UK has suffered and do you think there is a role in Europe, within CAP, to correct this?

Pete Riley: I think the loss of ADAS as a free advisory service was a mistake, because it skews the advice that people get from agronomists. It would be very beneficial if the CAP could be reformed in a way that would allow us to get advice quickly on new techniques for farming so they could be adopted very quickly and over quite a large area of the country.

Whether that is possible, given the machinations of CAP negotiations, is a matter of debate, but, in the long term, if we are going to roll out sustainable farming systems, based around agro-ecology, we are going to need a lot of people with knowledge of how to develop biodiversity on a farm without it over-affecting its productivity; how to conserve nutrients on the farm; how to manage organic waste on the farm and how to incorporate organic waste from off the farm in a safe way. All these things need to be addressed.

To have people on tap who can talk to farmers, and point them in the right direction towards companies that can provide services and expertise, is going to be absolutely vital if we are going to get transitions to what we see as a sustainable farming future.

Emma Hockridge: What we have found most useful in the organic farming world is for the scientific research and new techniques being developed within organic systems to be passed from farmer to farmer by specific farmer-led groups. For example, we have found, in cases of farmers converting from non-organic to organic farming, that the best examples are when a neighbouring farmer has converted to organic production, and the other farmers see how well it works and take up the advice and information in that way. Whether that can be done via CAP is up for debate.

Q374 The Chairman: Doesn't the Soil Association have quite an extensive extension service—helping people if they want to convert?

Emma Hockridge: Yes. There are telephone services and there are regular seminars on general principles of organic agriculture and seminars for existing organic farmers on specific issues, for example on soil science, which of course is a key element to organic farming systems. They are very popular.

Q375 The Chairman: Have you had any elements of support for that from Defra?

Emma Hockridge: I believe there has been some in the past, but I don't think there is any at the moment. Most of that support comes via the fees which existing organic farmers pay.

Q376 The Chairman: And have you explored the possibility of support under Pillar II of the CAP?

Emma Hockridge: Not as far as I know, but it is certainly something that I can check.

Q377 The Earl of Caithness: In order to get the new techniques that you mentioned out to farmers, would that require a new vehicle? Would it have to be a Government-funded organisation rather like the old ADAS? Or could you see it being done using the private sector?

Pete Riley: There is a lot of scope for using the private sector, for instance in organic waste management; developing techniques which preserve nutrients in those wastes very effectively. One of my bugbears is to see piles of farmyard manure dumped in the middle of a field and left there for about three years, while all the nitrogen disappears into the air and into the water. How we actually conserve that nitrogen in a way that makes it available to farmers to put on their crops is the sort of area where the private sector could get in. Alternatively, using that same material to produce renewable energy on the farm could be another area for the private sector. Soil analysis and advice could easily be in the private sector and people could be asked to pay. We need a new way of thinking about farming that is much more integrated than we have got; integrating soil management, water management, biodiversity management, crop production and animal welfare. It would be very good if there were people who could come along and start joining those things up together. That may not lend itself to the private sector; that may lend itself much better to the public sector.

Q378 The Earl of Caithness: Can you really see farmers in the north of Scotland who dump manure in the fields as soon as we get a hard frost paying the private sector to tell them how to put it on the land?

Pete Riley: Not how to put it on the land, but how to store it. Defra, for instance, did a lot of research on ammonia losses from slurry. As far as I know, it is very interesting research that indicates different ways of managing slurry can reduce or depress the amount of ammonia lost. Those sorts of techniques are teachable one-to-one. It could be done by the private sector; it could be done by the public sector.

Q379 The Earl of Arran: Turning to research, Lord Melchett says of GM that many older people have a purely emotional and irrational belief in the power of science and technology to solve the world's problems. He may be right on this. But from the point of view of the Soil Association, if you consider scientific research a waste of time and money how would you like to see agricultural research being directed?

Emma Hockridge: No, we absolutely don't think that science and research are a waste of money. We need to consider exactly what type of scientific research is being carried out. The irrational, emotional belief in science that Peter points out is around this idea that there can be one individual quick fix. We have seen this when nuclear energy was being developed; the idea that it would be so cheap that we wouldn't even need to meter the cost of it. It is around the idea of looking at a holistic system and making use of the whole biological farming system—looking at what we've got at the moment—rather than trying to take out individual points and focusing on those as the only way that we can feed the world. We should; for example, be looking at new varieties of crops, breeds of animals, more traditional breeds, more low-input breeds etc. Even the Foresight Report highlighted the fact that there has been a lack of investment particularly in agro-ecological farming systems, to the advantage—we would argue—of GM and pesticide research. So we need to focus on a broad range of scientific research with a focus on agro-ecology.

Q380 The Earl of Arran: Thank you. Mr Riley says that research funding should be switched to agro-ecological research away from GM research. Is the lack of return on GM

research linked to the quality of that research? Or alternatively is it linked to resistance of public opinion? Or is it a mixture of both?

Pete Riley: I think it is a bit of both. One of the reasons why we don't see GM crops in this country is that there is no market for them. In 1998, supermarkets said that they weren't going to stock GM ingredients and they stuck with that policy. As a result, there is no real incentive for crops suitable for growing in the UK or Europe to be developed. Some of the money that has been put into GM research has led us down blind alleys. Take the example of the purple tomato developed by the John Innes Centre, which is supposed to be high in anthocyanins. They were claiming that it was giving all sorts of health benefits. The Food Standards Agency's chief scientist blogged on it the following day saying there is very limited evidence to link high levels of anthocyanins in food to health benefits and has not been systematically reviewed for instance by World Cancer Research Fund. We have an institution that is promoting itself through a technology and technique of producing a purple tomato, yet there is no basis in science at the moment to say that it is going to give any long-term benefits at all. Also, if you want purple tomatoes, they are out there already. Go and buy a Thompson and Morgan catalogue. They are already advertised. It is already being done by conventional breeders.

Q381 The Earl of Arran: How do you think the research councils should organise decision-making on research funding? That is a big question.

Pete Riley: I think we need a big shake-up. We need to start thinking about a systems approach to agriculture and how we can manage whole-farm systems, or even farms linked together in catchments, in a way that delivers the environmental goals that we are looking for; which at the same time enables farmers to produce viable crops that are needed for food security. There is a need—I am going to agree with the opposition here, heaven forbid—for multi-disciplinary approaches to research. We need to bring people together. We do not dismiss the need for plant breeding and genetics. We would like to see that continuing so that we can develop varieties of better quality and more well-adapted crops. But they have to fit into a system which is not dependent on non-renewable resources and which is non-polluting. There is a real need to bring all those disciplines together. As Emma pointed out, we are short of expertise in many vital areas, including conventional plant breeding in this country. We are short of people who know how to breed new varieties of crops. We need to address these issues and we need to do it quickly. I hope that the Beddington Report will trigger some changes in the way we approach agricultural research and extension. There is no point in doing the research unless it is applied.

Q382 The Chairman: Dr Bushell indicated in his evidence that the approach being used is a systems approach. He stressed the fact that GM in itself is not the only technology. A mix of technologies are being used. How would you explain the fact that these companies are going on developing GM strains—and one is seeing an expansion of the use of some of these GM crops in other countries—if they're not viable?

Pete Riley: There is not much activity in this country.

Q383 The Chairman: I know. The whole EU has a regulatory framework that is, at the moment, limiting the degree to which they're exploited here, but in countries where there are different regulatory frameworks there has been a considerable expansion.

Pete Riley: There has been an expansion in herbicide-tolerant, and insect-resistant, crops. There is very little else out there in commercial growing.

Q384 The Chairman: Are you saying that it is not viable?

Pete Riley: We are saying that, after a few years of running the crops, the whole problem of resistance in herbicide tolerance becomes so acute that the viability of GM farming as it was sold to farmers in the first instance is no longer applicable. Now, we are seeing a quite different sort of GM farming, where we are using not just one but a whole range of weed killers. That takes us back to where we were before GM came in. Rather than just using one, we're now using a cocktail of chemicals to control weeds.

Q385 The Chairman: Have you got evidence to support that?

Pete Riley: All we can say is that we know which crops are available commercially for sale—which seeds farmers can buy—and the vast majority of them are either insect-resistant or herbicide-tolerant or a combination of both.

Q386 The Chairman: Yes, but you are claiming that both of them are using more pesticides than they were.

Pete Riley: In the case of herbicide tolerance, that appears to be the case.

Q387 Lord Cameron of Dillington: If you talk to the Argentinean farmers, you'll find that they will disagree with you. They are not economically insane. They hardly put any chemicals on their crops any more because of the new varieties. What you are saying probably applies to one or two parts of the United States.

Pete Riley: No, these weeds cover vast areas. I can send you information about this. It is well documented in the scientific literature.

Q388 The Chairman: If you have good evidence to support what you're saying, we'd be interested to see it.

Pete Riley: Certainly, there is a vast body...

The Chairman: Don't send us too much. One seminal article will do.

Pete Riley: There is rising concern among weed scientists in North and South America about this problem. It's not going to go away. It will increase the amount of herbicides. In terms of insect-resistant crops, there is evidence that, among single-gene Bt crops in India, the pest has overcome the Bt toxin in the crop in some areas, like Gujarat. In other parts, particularly in China, they've stop using insecticides on cotton because the farmers believed that the Bt toxin killed all the insect pests. It doesn't—it kills specific ones—and they've got secondary pests coming in, which are largely sucking insects that would have been normally controlled by the pesticides used on the crop because they increase in numbers. They're now seeing an increase in the amount of insecticides used to control those secondary pests. So it's by no means a clear picture.

There are very good studies around, particularly from the STEPS Centre at Sussex University, showing that, if there are benefits from Bt cotton in the Indian subcontinent, they accrue to the wealthy farmers who have already got the necessary irrigation and access to fertilisers. It's by no means a pro-poor technology. That is a very clear conclusion from a paper that was published in 2009.

Emma Hockridge: We have seen that the introduction of GM crops has come at a time when oil supplies have been relatively plentiful. We have been able to produce and cultivate crops in these relatively intensive systems using artificial nitrogen fertilisers and energy.

Moving into the future in terms of a resource-depleted world and one where climate change is going to be a growing issue, we will see that we will need different types of farming systems such as agroecology. We won't be able to have these very large scale monocultural farming systems in the future when oil prices are much higher.

Q389 Lord Cameron of Dillington: You haven't quite answered our Chairman's questions. In the light of all of what you have said, why do most farmers in 25 countries still yearn for more GM seed?

Pete Riley: The actual area of agricultural land under GM crops globally is about 2.5 per cent. The vast majority of agricultural land across the world still has no GM crops. The number of farmers is around about one per cent. That's the context. We're dealing with a limited number of crops: soya, maize and cotton, principally, with some oilseed rape. Some of the real staple crops, like potatoes, wheat, barley, oats and a lot of the crops in Africa, are still non-GM. What's lacking are breeding programmes and agronomic research based on agroecology to enable these crops to be grown.

The farmers in the global south—as was said—are poor and they're not going to be able to afford the expensive GM seeds and expensive inputs. We need to find a system that works for them, around using locally available resources in the agroecological approach. This is where we need to see the big research effort and for the UK to take the lead. It would be great if we did.

The Chairman: Thank you. Lord Cameron, do you want to come in on the future of the CAP?

Q390 Lord Cameron of Dillington: I would be interested in your comments on how you see the future CAP. Ms Hockridge, you say that you think they ought to look for more holistic support for farming systems and avoid specific interventions. You also called for money to move from Pillar I to Pillar II. Will you say a bit more about how you see this working and whether you are concerned that, if more money was moved into Pillar II—which, of course, is being co-funded—we might get a reduction in research into the areas you are looking for?

Mr Riley, can you give us examples of support in other EU member states for your desire to see more agro-ecological management systems generally? Is this a particularly UK viewpoint or might this happen because there is support across the continent?

Emma Hockridge: In terms of CAP and specific support, I referred to the case of minimum tillage as an example of one individual intervention. Defra had said that it was very keen on this as a way of reducing energy use on farms, et cetera, but now it has done lots more research on the issue, it is saying that perhaps it is not quite as useful as it had thought. In the mean time, that individual technique has been put into lots of policies—for example, it is still in the soil management booklets that all farmers receive—but the science has moved on. There is a danger with using ideas which seem, on the surface, to be very attractive, but which are not borne out in reality. Using existing, whole-system approaches, such as organic farming, which has been proved scientifically over many years to have certain benefits, is a more useful approach for CAP when reform takes many years.

Moving some money from Pillar I to Pillar II has been a long-discussed issue within Europe. There is a lot of enthusiasm for encouraging more environmentally friendly farming practices and supplying more money through Pillar II is one way of enabling farmers to be supported to do that. We wouldn't advocate getting rid of Pillar I entirely—we still think it is important

for farmers to have support, but farmers, if they receive that support should supply public goods, since the finance for CAP comes from the general public. Farmers with those Pillar I payments should be supplying adequate public goods.

Pete Riley: On the agro-environment point, the UK is probably the country that has done the most thinking about this approach, with limited success so far, to be honest. The core paper that the Commission published last year supports greening the CAP, but when you start looking at what other member states are saying, the picture is extremely patchy. It will be an uphill struggle to get that sort of policy adopted over the whole EU. As far as I can make out, France has slightly nuanced its position recently from being fairly anti to saying, well, maybe. There is room for negotiation, but the key thing will be to have flexibility in how member states are allowed to use the money to fit what their policy goals are on protecting biodiversity, protecting water supply or whatever.

Q391 Lord Cameron of Dillington: That is most likely to be Pillar II money, isn't it, because that is more regional?

Pete Riley: It is likely to be, unless there is some strengthening of Pillar I that makes these things more tied-in to area payments. But, again, the 27 member states will probably have 27 different agendas that they are working to, so the outcome will be unpredictable. That doesn't mean that the UK Government shouldn't be calling very strongly for it and trying to build support for the long term. This is a crucial round of reforms in setting the agenda for Beddington-type changes.

Q392 Lord Cameron of Dillington: Do you know of any European continental research stations that are targeting their work at a whole-systems approach, or is it all done on crops and individual varieties?

Pete Riley: I think INRA in France is quite innovative.

Emma Hockridge: FiBL in Austria is probably the largest.

Pete Riley: INRA are doing all sorts of research. There is good research going on at Rothamsted and the Scottish Crop Research Institute.

Emma Hockridge: Newcastle University as well.

Pete Riley: Bringing that together, trying to make sense of it and how it would work at farm level—which is where the gaps are—that's the challenge for the BBSRC and for the Government, to make sure that that happens. There is no point chucking public money at what is very interesting research on pollination and how you increase pollinators on the farm if it never gets put into practice.

Q393 The Chairman: Mr Riley, I notice that GM Freeze describes itself as an alliance of 30 organisations calling for a moratorium on GM foods and the growing of GM crops. In effect, we have had something of a moratorium in Europe for 15 years. Do you sense that Europe is moving in a different direction from the US and towards where you and Ms Hockridge would like to see farming move, picking up a more holistic approach to farming, moving towards an integration of non-GM methods? Do you see this developing? We have had a 15-year experiment now.

Pete Riley: Very slowly, we are seeing things move in that direction. Reports such as the international assessment report will, I hope, encourage scientific institutions and funding bodies to start thinking more holistically, as you put it. But it is very slow progress. The debate on GM has been characterised by the previous witnesses as being politics versus

science and it certainly is not that. There is a scientific debate at the core of the European argument on GM. There is an argument about how you assess the safety of crops still going on; there is an argument about how data submitted by the individual companies is interpreted and what the significance of chemical changes in food is. That debate is going on and while it goes on, it is hard to see how there will be any massive progress in developing GM crops for Europe. We need to get the sort of sea-change that I have been talking about whereby we look at systems rather than just individual crop productivity and maybe the CAP is an opportunity to do that.

Emma Hockridge: In terms of movement at a public, consumer level, one example of a move to encourage more holistic systems has been the continued growth of the organic market in other European countries, even in a recession. In the UK we have seen a slight drop, which is now rising again—people want to buy organic food. Linked to that, the idea that the public and organisations such as ours are somehow being emotional or irrational versus cool, hard science is almost slightly insulting. It is very difficult to have a proper conversation around the issue of GM while there is a view that it is science versus emotion. In fact, many of the concerns raised by the public and NGOs a number of years ago are beginning to be shown to be true.

Q394 The Chairman: The organic market has probably grown faster in the United States and Canada, has it not?

Emma Hockridge: Absolutely. Linked to the GM issue, there was a new non-GMO label launched in the US around a year ago and it is the fastest growing food label in the US at the moment. That is one example of the US public beginning to turn away from GM food.

Q395 Baroness Howarth of Breckland: You were talking about emotional reactions, but it was your Lord Melchett who said that older people have an emotional reaction to technology. I think it is the other way around and that both sides should back down on this and get looking at the science. Your evidence suggested that older people accept technology. Our evidence, and certainly my experience in both rural and urban communities, is that older people are exactly the opposite of what was described in that article. I want to put that right—the emotion is on both sides.

Emma Hockridge: Bear in mind that he was relating that to a specific issue.

The Chairman: Thank you very much indeed for coming. We have come to the end of our questions, but it has been a very useful session. Thank you.

Supplementary written evidence from the Agricultural Biotechnology Council (IEUA 35)

Q: In your written submission, you say that “the translation of scientific work to meaningful on-farm advice is an area of deficiency in the UK, with extension services essentially a thing of the past, at least in England and Wales”. We have heard from ADAS that, since privatisation, their approach has changed, so that advice reflecting their expertise is often delivered to farmers through intermediaries, such as farm supply representatives:

- what would you recommend as the basis for the effective provision of advice to farmers? Who should be responsible?*
- does your parent organisation, EuropaBio, have alternative, and perhaps better, experience from around the European Union?*

A: By way of follow-up you asked for abc's view on extension services and we would refer the committee to the excellent report³⁰ produced for the All Party Parliamentary Group on Science and Technology in Agriculture ...

It is clear that access to free, fully independent agronomic advice is difficult to come by at the individual farm level, although levy boards such as the Potato Council and Home-Grown Cereals Authority – within the Agriculture and Horticulture Development Board, continue to provide a significant range of variety, crop management and agronomy-related advice. Likewise, individual farmers will seek advice from tied and independent agronomists and from groups such as NIAB and ADAS although this is unlikely to be free. For the introduction of new technology such as GM crops, there would be envisaged to be significant advice from the technology providers, who would be very keen to see such innovations adopted in an effective and responsible manner. Likewise any coexistence measures - which are currently being drawn up by the cross-industry group SCIMAC (www.scimac.org.uk) - would also have to be communicated.

The committee also requested information on our experience of extension services in other EU Member States. Two examples will illustrate the variability of provision across Europe. The first is Germany, which, as will the UK used to have an extensive network of "free" advice for farmers, provided at a State (Lander) level. In the last 10 years, such access has deteriorated and replaced with fee-for-service activity. Thus Germany has currently not reached the extreme position of the UK but is certainly heading in the same direction.

If this question had been asked of France 10 years ago, the response would have been very similar with an extensive tax-payer funded extension service which has deteriorated. However, with the advent of the *Grenelle d'Environnement*³¹ in the mid 2000's, it was recognised that farmers had had to "go it alone" too much and that the quality of best practice, and application of new innovations had deteriorated too far. In response to this recognition, there has been significant investment at a Government level and extension services have been revitalised.

So it seems reasonable to take the view that the UK and France represent extremes in this area with the UK relying on almost exclusively "fee-for-service" advice and France moving back towards more of a traditional extension service set up.

³⁰ This is the report by Professor David Leaver, who gave evidence to the committee on 12 January.

³¹ This is usually translated as the "Environment Round Table", and was an initiative of the French Government. More information can be found at: <http://www.legrenelle-environnement.fr/-Version-anglaise-.html>

Supplementary written evidence from GM Freeze (IEUA 40)

During oral evidence by Pete Riley (GM Freeze) and Emma Hockridge (Soil Association) the Committee requested further information on weed resistance in genetically modified herbicide tolerant crops (GMHT) crops and on the yields of GM crops.

This additional evidence seeks to cover the Committee's request.

I. Weed Resistance

Weed resistance is now a significant agronomic, economic, health and environmental issue in areas where GMHT crops (or Roundup Ready (RR) crops) with tolerance to Monsanto's Roundup have been grown over a number of years and where Roundup/glyphosate has been the only, or very dominant, means to control weeds. The situation is now so serious that some pro-GM crop commentators are urgently calling for action to prevent the loss of glyphosate as a herbicide in GMHT crops (Powles 2008).

The glyphosate resistance genes in weeds may have been present in weed genomes before RR crops were introduced or may have arisen from mutations since then. The heavy use of glyphosate has resulted in the weed biotypes with the resistance genes present being selected for and the spread has been quite rapid in some species (see below and in video clip by Robert Nichols).

The evolution of glyphosate resistance in GMHT crops in the US and S America followed a brief honeymoon period when the technology proved to be very effective in controlling troublesome weeds. However it was often those same troublesome weeds that first developed resistance to glyphosate (Powles 2008). For instance: Palmer Amaranth (*Amaranthus palmeri*) in maize cotton and soybeans in the USA since 2005; Horseweed (*Conyza canadensis*) in cotton, soybeans and maize since 2000 and in soybean in Brazil in 2005; and Johnsongrass (*Sorghum halepense*) in soybeans Argentina (2005) and USA (2007). Several of the most problem weeds are also resistant to other herbicides modes of action in addition to glyphosate. In addition, glyphosate resistant volunteer plants cause additional problem in other RR crops, for instance RR maize in RR soya.

For background to the issue (including multiple resistant weeds) we recommend that the Committee refers to our 2010 briefing on the subject.

(http://www.gmfreeze.org/uploads/resistance_full_Briefing_final.pdf)

Glyphosate resistance in weeds is not an event exclusive to GMHT crops but there appears to be consensus amongst weed scientists that their development has been accelerated by the over reliance of glyphosate in RR soybeans, cotton and maize and the use of zero tillage in these crops.

- “Most of the documented cases of evolved GR [glyphosate resistant] weeds in the past 6 years have been in GR crops” (Duke and Powles 2008).
- “Because glyphosate is the herbicide most often used in no-till and minimum-till systems, GR [glyphosate resistant] volunteer crop plants and glyphosate-resistant or tolerant weeds will jeopardize the sustainability of those systems” (Mallory-Smith & Zapola 2008).

The situation in South America is following a similar pattern to that in the USA (Binimelis et al. 2009).

Since GM Freeze published its briefing, the urgency of the need to develop strategies to prevent resistance to glyphosate developing has greatly increased amongst weed scientists. The following video clips are worth watching to get a sense of how seriously weed scientists, industry and the media are taking this issue in relation to RR cotton.

Larry Steckel, University of Tennessee
http://www.youtube.com/watch?v=2_ijhIGtOJM&feature=related

Robert Nicols, Cotton Incorporated
<http://www.youtube.com/watch?v=T2wTlzxSG8>

GeorgiaFarmMonitor
http://www.youtube.com/watch?v=ZUt_pp3NUUc&NR=1

Monsanto are also taking the problem seriously as it represents a threat to their main sources of income: RR seeds and Roundup sales. They have embarked on major changes in weed management in RR crops which still includes the use of glyphosate but in mixtures and combination with other herbicides which is increasing herbicide usage on these crops. So instead of the promised decrease in pesticide use on GM crops the arrival of resistant weeds has resulted in herbicide use increasing on RR crops. Analysis of USDA data (Benbrook 2001, 2005 & 2009) has found progressive increases: 39% rise for maize (1996-2005); nearly 200% for cotton (1996-2007); and nearly 100% for soybean (1996-2006).

Previous attempts to control resistance weed by increasing the rate at which glyphosate has been applied have proved to be unsuccessful. Monsanto appears to have no intention of taking responsibility for the failure of their technology:

“Growers must be aware of and proactively manage for glyphosate-resistant weeds in planning their weed control program. When a weed is known to be resistant to glyphosate, then a resistant population of that weed is by definition no longer controlled with labelled (sic) rates of glyphosate. Roundup agricultural herbicide warranties will not cover the failure to control glyphosate-resistant weed populations” (Monsanto undated).

The company has published guidance on how to deal with the growing weed resistance problems in RR crops (Monsanto, 2010a) and have already started to develop prevention strategies based on the use of combinations of herbicides and timing of applications. The first method is the use of tank mixtures of glyphosate and other herbicides (for instance 2.4 D is recommended for marestail (Monsanto 2008)) pre-sowing to “burn down” weeds.

The second approach is to produce GM seeds with several herbicide tolerant genes (gene stacking) by crossing GMHT varieties with different tolerant genes so different herbicides can be applied to the growing crop in rotation or in tank mixes to ensure that weeds which are resistant to glyphosate will be killed by other herbicides. For instance, Monsanto have recently announced an agreement with the German pesticide and biotechnology company BASF to develop crops stacked with glyphosate and dicamba tolerant genes (Monsanto 2010b).

The third method is to use herbicides that remain active in the soil (residual herbicides or residuals), which kill seedling weeds as soon as they germinate.

Monsanto have secured co-operation with other companies to include their soil residuals in their “weed management platform”. In October 2010, the FMC Corporation agreed to allow their “Authority” herbicides to be used with RR crops as part of Monsanto’s offer to farmers struggling with resistant weeds (Monsanto 2010c). These residual soil acting herbicide are based on sulfentrazone in combination with other herbicides depending on the formation. Previous to this Monsanto also announced a link-up with the Valent Corporation’s subsidiary the Sumitomo Chemical Co. Ltd to include flumioxazin based residual herbicides in the RR soya ”platform” (Monsanto 2010d) in South America. On the same day Monsanto signed a similar agreement with the Makhteshim Agan Group (Monsanto 2010e) to use their herbicides. Earlier in 2010, Monsanto received approval to use an Acetochlor based formulation for early emergence weed control in cotton (Monsanto 2010f)

It is clear that the over use of Roundup on RR crops has come close to making glyphosate obsolete in many areas on the US and S America and that only when it is used in combination with other products can it be effectively applied by growers. Thus the outcome is an increase of pesticide usage and the toxic burden on the environment from a cocktail of chemicals now needed to control weeds in RR crops. The herbicides being used with glyphosate, such as 2,4 D and dicamba, are old, chemicals which were being phased out because of their toxicity and were supposed to be a thing of the past when RR crops came in. Future options for chemical weed control are limited by the lack of new chemical herbicides in the pipeline. As Steckel points out (see video clip above)there has been no new herbicidal chemical introduced since the early 1990s and there is no sign that a new chemicals is anywhere near commercial production. Over reliance on glufosinate ammonium (Liberty) by growing Liberty Link (LL) GM crops would also risk weed resistance developing and comes with concerns about mammalian toxicity (EFSA 2005).

There is also a growing body of evidence about the safety of glyphosate for human health, wildlife and the soil/plant health (PANAP 2009).

Conclusion

Weeds resistant to glyphosate are present in most major RR crops in the USA and South America to the extent that the easy weed control techniques which attracted farmers to adopt the technology are a thing of the past. Farmers are now faced with increasingly complex weed management strategies, increased costs and a supplier who appears to want to shirk responsibility if weed control fails due to resistant weeds being present in the crop. In some cases, such as Palmer amaranth in RR cotton, growers have had to resort to hiring labour to had pull weeds at their own expense (see Steckel video clip). Far from making life simpler for farmers, the arrival of glyphosate resistant weeds in RR crops has led to the return of weed control methods more in keeping to the 1940s than the 21st century.

2. GM Yields

The actual yield of any crop is the product of its genetic make-up and how it responds to the environment in which it is growing which can change very rapidly (for instanced from drought conditions to water logging in a very short space of time). The current generation of GM crops mainly have either herbicide tolerance, insect resistance or combinations of

both. These traits are primarily agronomic and are not targeted at increasing yield per se but may do so indirectly when weed pressure or insect infestation reaches an economic threshold. It should be remembered that weeds and pests are also controlled using a variety of means in other cropping systems (both chemical and non-chemical approaches are used) and that weed resistance to herbicides and insect pest resistance to GM insect toxins are on the increase.

GM traits which would increase the intrinsic yields of crops, such as altering photosynthetic pathways and incorporation of nitrogen fixing into wheat have been described as “high risk” by the Royal Society’s Reaping the Benefits Report (Royal Society 2008). The genetic modifications required are far more complex than the single traits seen so far and these changes may interfere with other biochemical pathways in addition to the target. They may be 30-40 years away if, indeed, they prove to be possible. It is worth noting that genetic traits which show great promise in the lab and therefore may have been patented may not transfer successfully into a commercial variety:

“It is necessary to point out the commercial reality that few, if any, of the patents and applications in these lists will ever produce a financial profit. The most common reasons for this lack of success are unexpected additional costs of development or failure of the underlying science during the transfer from laboratory to field scale” (Dunwell 2010).

A review of the performance of GM crops in the US (Gurian-Sherman 2009) examined data on yields in the US concluded that GM traits have made a comparatively small contribution to corn yield increases since commercial growing commenced in the 1990s:

“Our review of available data on transgenic Bt corn, as well as on transgenic HT corn and soybeans, arrives at an estimated total yield benefit of about 3–4 percent for corn”.

And

“ corn yields over the past several decades have increased an average of about 1 percent per year—considerably greater than the increase that can be attributed specifically to GE. Corn yields have increased about 28 percent since Bt corn was first planted commercially (as determined by comparing the average yield for the five years preceding the introduction of Bt corn with the average yield over the past five years). But the 4 percent yield enhancement contributed by Bt varieties constitutes only about 14 percent of this overall corn yield increase, with 86 percent coming from other technologies or methods”.

One of the problems of assessing the impacts of GM traits on yields is that often the varieties under comparison have significantly different genomes. As Gurian-Sherman (2009) points out:

Ideally, the background genetics of the GE and non-GE varieties should be identical except for the presence or absence of the transgene. In practice, however, such complete genetic identity is not possible, though it can be approximated in so-called “near-isogenic” (NI) varieties

Recent university run crops trials of soybeans, maize and canola in North America demonstrate the point that the presence of GM traits for herbicide tolerance and insect

resistance is no guarantee of higher yields and that external stresses on the plant have far greater impact on yield than the presence or absence of GM traits. Below we summarise three sets of university trial data for canola (University of Idaho), corn (Iowa) and soybeans (Michigan). In all these trials none of the varieties tested can be confirmed to be near isogenic.

A. University of Idaho Winter Canola and deep furrow trials 2009

<http://www.cals.uidaho.edu/brassica/Variety-trial-info/Report%20WVT%2009.pdf>

These trials were conducted independently of the companies which supplied the seed for testing by the University of Idaho. The companies paid a fee to enter varieties in the trial although these did not cover the full costs which were made up by the institutions that conducted them.

Nineteen Brassica napus canola or rapeseed cultivars and breeding lines plus three control cultivars; 'Dwarf Essex' industrial rapeseed (B. napus), 'Bridger' industrial rapeseed (B. napus), and 'Salut' canola (B. rapa), were planted in the fall of 2008 at eight locations. One third of the cultivars entered were Roundup Ready types, and these are designated with "RR" in their names (7 in total).

Two trials were abandoned because dry conditions led to poor germination.

Regional variety trials

This trial was set up to assess the performance of the winter canola varieties in the climate of the Pacific NW of the USA.

There were considerable differences in the mean yield achieved between the different trial sites ranging from 2337 lbs/acre to 4426 lbs/acre (an 89% increase between lowest and highest) clearly illustrating how the environmental difference between sites affected all the varieties tested. Yields of all the varieties tested ranged from a low of 1880 lbs/acre to a high of 4703 lbs/acre across all the trial sites.

The trial report says:

"work needs to continue to develop cultivars that are better adapted to direct seed systems and that have increased winter hardiness in the seedling stage to allow later planting during dry falls and in recrop situations".

"As in previous years these trials demonstrated that even with timely late summer rains, establishing winter canola can be difficult at some sites, especially in direct seed situations. In fact, both direct seed sites were abandoned this year because of poor emergence".

Performance of RR Varieties

Seven RR varieties from four companies were tested (four from Monsanto, one from DL Seeds, one from Crop Plan Genetics and one from Wilbur Ellis Co). The RR varieties average yield was 3475 lbs/acre compared to the conventional varieties 3675 lbs/acre (5.7% higher).

The results show that only one of the RR varieties made it into the top ten varieties for yield (HyCLASS 154W RR from DL Seeds). The other RR varieties occupied positions 11,

15,16,18,19 and 20 out of a total of 22. The performance of the DL Seeds variety may be explained by the performance of the company's non-GM varieties which finished first and second in the ranking suggesting that their gene pool for canola is well adapted to this region of the USA.

Deep Furrow Trial Trials

This trial was on a smaller scale than those for the 22 varieties. The purpose was to test the growing system to see if it led to earlier planted varieties establishing better and making better use of the available soil water. The average yield, at the one site used, was only 2594 lbs/acre compared to 3609 lbs/acre in the main trials. In this trial, Monsanto's DKW.45-10 RR (GM) came out best and a high non-GM performer from the main trial came last of five varieties (12.9% higher than the mean). The research team put forward the following explanation for this reversal:

"DKW 45-10 is a moderately early cultivar, and this attribute might have given it an advantage" (in this trial at this site)

They also suggested that:

"The relative branching ability of each variety could have had an effect on yield as well, since the trial utilized extremely wide row spacing".

Thus the explanation from the researchers for the good performance of the RR variety was based on its traits for earliness and branching neither of which are affected by the presence of the RR gene.

Incidentally DKW.45-10 RR performed much better in the main trial compared with the deep furrow trial - 2928 lbs/acre in the deep furrow trial against 3418 lbs/acre in the variety trial (>16.7%).

These trial results illustrate that the presence of RR genes in canola do not guarantee a high yielding variety and it is the background genetics of the variety that counts most. Generally the RR varieties performed worse than the conventional (>5.7%).

It is worth noting that the RR is promoted as the key breakthrough for zero tillage systems of cultivation whereas for winter canola in the Pacific NW of the US, the ability to germinate and survive when soil moisture is low seems as important as any other trait.

B. 2010 Iowa Corn Performance Test

http://www.croptesting.iastate.edu/corn/reports/corn_2010_finalreport.pdf

Every year Iowa State University carry out performance trials for corn varieties in a number of state districts and several locations in each district. The 2010 trials included the latest Smartstax GM maize varieties.

The result for each variety entered into the trials is compared to the average for the whole district. For the purpose of this analysis the yield as percentage of the district average is compared as well as average yields for particular varieties tested. Most of the varieties tested in the Iowa trials were GM hybrids with either single traits (herbicide tolerance or insect resistance) or stacked traits. Some varieties (about 23 out of 230 hybrids tested) were non-GM and contained neither insect resistant nor herbicide tolerant GM traits.

The 2010 performance test was therefore primarily a comparison of GM varieties. It is therefore not surprising that a GM variety was the best performer in each district but as there was no information regarding the parents of the hybrids it is impossible to assess the significance of the GM traits compared to the background genetics in each variety.

Smartstax varieties were tested and were easily identifiable in the results from information provided in the report. This maize has eight GM traits in total – six for insect resistance and two for herbicide tolerance. The Iowa performance test included 11 varieties of Smartstax, produced by four companies, which were trialled at 22 sites across six districts. The 23 non-GM varieties tested were produced by 7 companies.

Smartstax's Performance 2010

The overall performance of all the Smartstax varieties was poor compared with the other varieties trialled – on average Smartstax yielded 5.75% less than the district average (see table 1 below).

Table 1 Smartstax variety performance

Company/Brand	Variety/entry	District	Relative maturity in days	Yield as % of district average	Yield in bushels per acre
Mycogen	2P486	NW	<104	95%	166.3
Mycogen	2J597	NW	104-110	100%	177.6
Renk	RK764SSTX	NW	104-110	91%	160.7
Cornelius	C53SSTX	NW	104-110	91%	160.5
Epley	E2472SS	NW	104-110	90%	159.3
Mycogen	2P486	NE	<104	98%	170.3
Renk	RK619SSTX	NE	<104	96%	167.9
Mycogen	2K594	NE	104-110	102%	186.8
Mycogen	2J597	NE	104-110	101%	184.0
Cornelius	C536SS	NE	104-110	94%	171.2
Renk	RK764SSTX	NE	104-110	90%	164.1
Epley	E2472SS	NE	104-110	89%	163.2
Mycogen	2D692	Central West	104-110	101%	190.9
Epley	E2472SS	Central West	104-110	88%	166.8
Cornelius	C536SS	Central West	104-110	88%	166.3
Mycogen	2D692	Central East	104-110	99%	180.6
Epley	E2472SS	Central east	104-110	93%	168.7
Renk	RK764SSTX	Central east	104-110	92%	168.3
Cornelius	C536SS	Central east	104-110	92%	168.2
Mycogen	2D692	SW	109-112	97%	183.5
Epley	E2472SS	SW	109-112	86%	163.3
Micogen	2T784	SW	>112	99%	167.0
Micogen	X21771	SW	>112	94%	158.7
Micogen	X21771	SE	>112	96%	135.8

Smartstax average				94.25%	168.7
--------------------------	--	--	--	---------------	--------------

The yield as a percentage of district average for non-GM varieties is shown in the table 2 (below). These performed far better than Smartstax and came out just 0.4% below the district mean on average. Overall GM varieties which were not Smartstax performed best across the trials.

The actual yields from Smartstax compared poorly with the non-GM varieties. The 24 trials of SmartStax average 168.7 bushels per acre compared with 176.3 bushels per acre for the 46 trials of non GM maize tested – 4.3% lower. The average yield from all varieties tested for each district ranged from 141.7 to 191.8 bushels per acre which suggests that local factors, such as soil, disease/pest pressure and weather, played a big part in how crops perform. The performance of individual varieties varied greatly between different districts. For example, Delkab's DKC61-69 (GM) varied between 156.4 bushels per acre in the SE district and 200.6 bushels per acre in the SW district – a 22% reduction. Mycogen's Smartstax variety 2D692 yielded 190.9 bushels per acre in Central west but only 180.6 bushels per acre in Central east district (down 5%). The performance trials do not attempt to explain these variations but they clearly indicate that the prevailing environmental stresses and the impact they have on the plants is more important than the presence of GM traits. Again this illustrates that yield is the product of how the whole crop responds to differing external stresses such as low rainfall, high wind, fungal disease or insect pests.

Table 2 Non-GM hybrids performance

Company/Brand	Variety/entry	District	Relative maturity in days	Yield as % of district average	Yield in bushels per acre
Epley	E1311	NW	<104	97%	169.4
Prairie	2730	NW	<104	96%	166.3
Prairie	590	NW	<104	94%	163.4
Cornelius	C462	NW	104-110	103%	182.4
Rainbow	X1079	NW	104-110	103%	182.2
Epley	E1471	NW	104-110	102%	181.0
Prairie	4760	NW	104-110	101%	178.4
Prairie	5879	NW	104-110	99%	175.6
Prairie	3074	NW	104-110	96%	169.9
Titan Pro	1059	NW	104-110	95%	168.6
Viking	40-09N	NW	104-110	94%	165.8
Epley	E1170	NE	<104	104%	182.1
Viking	60-01N	NE	<104	101%	176.0
Prairie	579	NE	<104	100%	174.2
Prairie	2730	NE	<104	97%	169.1
Epley	1311	NE	<104	95%	165.7
Epley	E1471	NE	104-110	103%	187.7
Titan Pro	1098	NE	104-110	102%	186.4
Prairie	5879	NE	104-110	101%	183.9
Cornelius	C462	NE	104-110	100%	181.8
Titan Pro	1059	NE	104-110	99%	180.3
Prairie	4368	NE	104-110	98%	179.0

Viking	40-07N	NE	104-110	97%	177.4
Cornelius	C591	Central west	104-110	110%	209.0
Prairie	4760	Central west	104-110	107%	202.4
Rainbow	X1079	Central west	104-110	103%	196.2
Epley	E1471	Central west	104-110	98%	186.2
Prairie	3074	Central west	104-110	93%	175.9
Titan Pro	1059	Central west	104-110	91%	173.7
Titan Pro	1149	Central west	109-114	107%	194.3
Prairie	7820	Central west	109-114	105%	191.0
Rainbow	3157	Central west	109-114	96%	174.8
Prairie	5879	Central east	104-110	101%	184.2
Rainbow	X1079	Central east	104-110	99%	179.7
Prairie	4368	Central east	104-110	98%	179.2
Titan Pro	1059	Central east	104-110	98%	177.8
Prairie	5820	Central east	104-110	96%	174.4
Prairie	7820	Central east	109-114	106%	202.4
Master choice	MC-534	Central east	109-144	96%	184.1
Rainbow	3157	SW	>112	99%	166.7
Prairie	7820	SE	109-112	110%	176.1
Cornelius	C591	SE	109-112	104%	167.2
Rainbow	X1079	SE	109-112	101%	161.6
Prairie	8229	SE	>112	100%	141.4
Titan Pro	1149	SE	>112	94%	133.8
Rainbow	3157	SE	>112	94%	133.0
Non GM average				99.6%	176.3

The Iowa performance trials for maize show that Smartstax maize varieties did not yield as well as conventional or other GM varieties in the environments where they were tested. Whether this effect was due to yield drag (the impact of the GM traits on the physiology of the hybrid) or yield lag (the impact of background genetics of the parent plants which were genetically modified and crossed to produce the hybrids) is not known. Both may be playing a part. External factors had a noticeable impact on the performance of individual varieties.

Thus the insertion of GM traits in corn alone cannot guarantee higher yields. The performance of crops comes from how well they are adapted to local conditions – and that is a product of all the genes in the plants and their relationship with the prevailing environmental conditions which vary from season to season and within seasons.

C. Michigan State University Soy Trials 2010

<http://www.css.msu.edu/varietytrials/soybean/2010%20pdf/2010%20Performance%20Report-final.pdf>

Table 1 Soybean Trials 2010 Summary

Region	Variety type	Mean yield bu/acre	Max	Min	CV	LSD % (0.05)
Central	Conventional	45.1	50.7	38.8	11.3	3.0
Southern	Conventional	51.3	57.3	39.1	10.9	3.3
Central	RR (early)	48.6	51.3	44.7	11.2	3.2
Central	RR (late)	49.3	53.4	44.7	10.1	2.9
Southern	RR (early)	57.8	62.8	53.6	9.9	3.3
Southern	RR (late)	57.6	61.9	54.4	10.2	3.4
Central and Southern	LL	53.3	58.6	49.6	9.4	2.4

Table 2 Soybean yield ranges

Region	Variety type	Range of mean yields between sites bu/acre	% difference min and max	Max range of mean yields within one variety between sites bu/acre	% difference min and max
Central	Conventional	28.1-55.0	95.8%	15.3-54.0	252.9%
Southern	Conventional	42.2-72.0	70.6%	24.4-52.3	114.3%
Central	RR(early)	34.0-58.6	72.3%	29.9-64.3	115.1%
Central	RR(late)	31.5-59.8	89.8%	24.4-59.4	143.4%
Southern	RR(early)	48.0-80.6	67.9%	41.3-83.0	101.0%
Southern	RR (late)	46.3-83.9	80.9%	42.9-93.8	118.6%
All	LL	28.7-58.8	104.9%	29.8-85.9	188.3%

RR crops weed control was with Roundup Ultra. In conventional and LL varieties weed control was with standard herbicides (with some minor variations the same for each plot). It is assumed that weed competition was not a major issue. One test centre (Saginaw) had a severe drought during the growing season and hence all varieties performed badly in comparison to other sites. Ingram district also had low rainfall. St Joseph district plots received irrigation and temperatures were high throughout the trials creating pretty well optimum conditions for growing.

The data (Table 1) indicate that for central area RR varieties average yield is 8.5 % more than conventional. In the southern region the increase is around 12.5%. No information about the background genetics of the varieties tested is given so it is impossible to say if this results from the GM trait and weed control or from the background genetics of each variety. However, a clue may be available in that in GM LL variety trials the same herbicides as the conventional were used and not Liberty (glufosinate ammonium) (which the GM trait provided tolerance to). The mean for LL trials was 53.3 bu/acre and compared to 45.1 and

51.3 bu/acre for conventional (an increase of 10.5% taking a mean for the conventional varieties). At the site with the best conditions LL also outperformed the conventional (77.0 bu/acre against 72.0 bu/acre), RR (early and late) yielded more than both (80.0 and 83.9 respectively). The LL/conventional comparison hints that the background genetics in the latter may be inferior in the conditions prevailing and this could explain the yield differences. No information about the genetics the conventional varieties or when they were first bred was given. The RR varieties may also have superior genetics for the condition in Iowa but unless information on parentage of the varieties is forthcoming no firm conclusion can be drawn.

Table 2 shows how yield varied hugely between sites for all types (GM or conventional) and within varieties. The differences are larger within individual varieties (GM or conventional) than they were between conventional and GM. This clearly illustrates how yield is strongly influenced by the prevailing conditions at each site (soil quality, temperature, rainfall, disease/pest presence etc) and how the whole genetic make-up responds to these external stimuli.

Without detailed knowledge of the background genetics and previous performance of parent varieties it is not possible to conclude whether the yield differences recorded are due to the respective weed control regimes facilitated by the RR trait or the underlying genetics of the varieties all of which would have arisen from conventional breeding programmes. Genetic modification was only used to insert the RR and LL traits which would only impact on yield if heavy weed competition was present in the trial plots for conventional but not GM. The trial report details weed control methods used in all plots and makes no reference to different levels of weed infestation which might have impacted on the results.

The Importance of the Socio Economic and cultural influences on crop performance

It cannot be assumed that GM seeds will automatically benefit all farmers equally especially poorer farmers who have no access to other crop inputs, such as fertilisers, or rely on rain rather than irrigation for water. We strongly recommend that the Committee read a paper that examines the performance of Bt cotton and the claims that it is pro-poor (Glover 2009):

“Those assumptions have involved the radical simplification of the complex agronomic and livelihood contexts into which GM crops have been inserted. They have thus undermined the usefulness and relevance of the information which has been presented to both farmers and policy makers.”

Conclusion

Yield of any crop in any year results from the interaction of its genome with the surrounding environment which can change greatly during the growing season. The current GM crops, herbicide tolerant and insect resistant, are not designed to increase the intrinsic yield of the crop but to help prevent losses due to weed and pest pressure. Resistance can undermine the ability of GM crops to prevent losses and increase pesticide use and costs. Increased yields in GM crops cannot automatically be assumed to result from GM traits.

References

- Binimelis R., Pengue W. and Monterroso I. 2009. "Transgenic treadmill": Responses to the emergence and spread of glyphosate-resistant Johnsongrass in Argentina. *Geoforum* 40:623-633.
- Duke S.O. and Powles S.B., 2008 Glyphosate: a once-in-a-century herbicide. *Pest Management Science*. 64: 319-325.
- Dunwell J.M., 2010. Foresight project on global food and farming futures. Crop biotechnology: prospects and opportunities. *Journal of Agricultural Science*. Published on line <http://www.bis.gov.uk/assets/bispartners/foresight/docs/food-and-farming/science/11-548-sr1-crop-biotechnology.pdf>
- EFSA, 2005. Conclusion regarding the peer review of the pesticide risk assessment of the active substance glufosinate. EFSA Scientific Report 27, 1-81
- Glover, D. 2009 Undying Promise: Agricultural Biotechnology's Pro-poor Narrative, Ten Years on, STEPS Working Paper 15, Brighton: STEPS Centre available at <http://www.steps-centre.org/PDFs/Bt%20Cotton%20web.pdf>
- Mallory-Smith C. and Zapola M. 2008. Gene Flow from glyphosate-resistant crop". *Pest Management Science* 64: 428-440
- PANAP 2009. Glyphosate. Available on line at http://www.panap.net/sites/default/files/monograph_glyphosate.pdf
- Powles, S.B. 2008. Evolved glyphosate-resistant weeds around the world: lessons learnt. *Pest Management Science* 64; 360-365.
- Monsanto, 2008. Management Guide for Maretails. <http://www.monsanto.com/weedmanagement/Documents/Marestail.pdf>
- Monsanto.,2009.NK603 - Roundup Ready Corn 2 Introduction Paper: 4-5.
- Monsanto, 2010a. Technology Use Guide 2011- The Source of Monsanto's Portfolio of Technology Products Stewardship Requirements and Guidelines for Use.
- Monsanto, 2010b. BASF and Monsanto Announce Progress in Dicamba Formulations. 2 Nov, 2010 Press release.
- Monsanto, 2010c. Monsanto, FMC Corporation Announce Crop Protection Collaboration With the Roundup Ready PLUS™ Weed Management Platform. 22 Oct, 2010 Press release
- Monsanto 2010d, Monsanto, Sumitomo Chemical and Valent Announce Long-Term Crop Protection Collaboration.19 October 2010 Press release.
- Monsanto, 2010e. Monsanto and Makhteshim Agan Announce Strategic Crop Protection Collaboration Crop Protection Leaders Bring Together Makhteshim Agan's Proven Molecules and Monsanto's Weed Management System. 19 October 2010 Press release.
- Monsanto 2010f. Monsanto Company Receives Approval for New Acetochlor Herbicide Formulation 2 February 2010 press release.
- Monsanto undated Glyphosate Resistant Weed Biotypes. <http://www.monsanto.com/weedmanagement/Pages/Glyphosate-ResistantWeedBiotypes.aspx>
- Royal Society, 2009, Reaping the benefits: Science and the sustainable intensification of global agriculture, Available on-line at <http://royalsociety.org/Reapingthebenefits/>

Supplementary Memorandum by Syngenta (IEUA 36)

Q: In your evidence (p. 4), you say that translation of practices is more likely to succeed through “practical demonstration”. Can you say more about how you think this should be done? Should CAP funding be provided or enhanced to support knowledge transfer (including, for example, demonstration farms) to help farmers innovate?

A: Ensuring good use as well as access to technologies remains critical to successful agricultural practice. Technologies often need to be demonstrated in order for farmers to understand how to apply them – this is true for individual technologies as well techniques. For example, the value of different spray nozzles is best seen first-hand in a field; as are the practices to establish and maintain biodiversity rich margins or different tillage practices that may offer solutions to reduce GHG emissions. So it would be useful if a stream of funding, perhaps from CAP, was allocated for investments in knowledge transfer activities, particularly where those activities focus on stewardship and environmental protection.

If the CAP structure is to change as the debate in Europe suggests there will be a greater focus on implementing practices which deliver clear, quantifiable, environmental benefits. Early adopters of new technologies, delivering useful benefits can be quickly identified and could serve as useful reference points for others.

Furthermore, any funding allocation may be further extended to support farmers who are actively involved in the R&D process, which may include trialing or “showcasing” new technologies or new agronomic systems and approaches. There could be substantial benefits in speed of uptake from bringing real farmers into the agricultural innovation process.

Funding allocated in ways which ensure farmers engage with technical developments have a clear two-fold benefit. In the short and medium term it would help to ensure that UK farming was able to reach its full potential in balancing high levels of production with environmental protection. In the longer term it would build a valuable agricultural knowledge base that would potentially be exportable, as regions around the world look how best to implement new practices in response to demands on food production systems. The international demand for advisory services will grow significantly in coming years.

Modern communication mechanisms such as “Social networks” may provide another source of information and advice for farmers. Relevant businesses and the state should support local groups and social networks that have the capacity to independently assess and transfer knowledge. A recent study for Defra³² looking at the role of influential individuals in encouraging and promoting ‘environmental behaviours’ offers insights into the identification and recruitment of such behaviour. It particularly addressed ways of mobilising what were dubbed ‘catalytic individuals’ in driving change. The committee may want to look further at this study.

³² “The diffusion of environmental behaviours; the role of influential individuals in social networks” (2007). See: http://randd.defra.gov.uk/Document.aspx?Document=EV0408_8307_FRP.pdf

Q: Would industry be prepared to meet the cost of a GM demonstration farm in a location prepared to accept such a facility?

A: No. It would be Syngenta's view that to create a single focus facility in the UK would only serve to reinforce inaccurate views that GM is a standalone technology. It is not - the technology is designed to work as one element in an agricultural system.

In addition, individual traits are designed to respond according to context, which includes factors such as weather, soil type, pest pressure, or water availability. Therefore, it also wouldn't be ideal to limit the trialling of GM technology to one fixed location because its applicability differs according to a range of variables. This might significantly limit the amount of currently viable technology that could be demonstrated in a single location. We should not forget that we already have some locations that could provide this public service, such as Rothamsted, JIC or perhaps, NIAB. Companies may be prepared to fund specific trials of their technologies in these locations and, indeed, already do so in some development programmes.

Lastly, based on previous experience, in establishing a single centre for running trials, we must face up to the perennial risk of vandalism of trials. While creating a single focus facility would arguably be better from a security point of view, the risk would be higher if identified specifically as a commercial centre, rather than a national facility.

National Institute for Farming and Food Investigation and Technology of Spain (INIA)

Written evidence (IEUA 12)

Definition of “innovation” in the agricultural context

1. Innovation is a mindset that drives towards an analysis of current status, identifies its shortcomings and limitations and strives to find responses and improvements. And it's therefore an unavoidable need for EU agriculture, highly productive in terms of yield but very resource intensive and environmentally costly. Perhaps more so, for Spanish agriculture which, in addition to the common challenges that EU agriculture faces, the Spanish agricultural sector is very complex and unique within an EU setting: fragmented land ownership, a very broad diversity of crops, some of which are almost testimonial but which require a full range of often specific agricultural practices (pest and weed control, harvesting, etc.). Some of our major crops do not exist in most of Europe (citrus, cotton, rice, etc. and are suffering for example of a lack of adequate pest control products, that have been banned at an European level without due consideration to the often distinctive needs of Spanish agriculture.

Commercialization of agricultural products represents a major problem, the marketing distance between producer and consumer being very extensive and complex with an array of intermediaries which add costs and inefficiencies.

Innovation is therefore needed in the structure of land ownership in order to gain in economies of scale, competence and ultimately productivity. It is also needed in purely agronomic variables, such as pest and weed control. And innovation is needed in the commercialization of agricultural products.

New technologies should be strongly encouraged as they will underpin innovation in agriculture, such as biotechnology in a broad sense (not just transgenic crops) which offers in principle a significant potential to solve some of the immediate and future challenges, such as, for example, quick adaptation to climate changes.

Innovation in EU agriculture as a strategic objective

2. Innovation in agricultural research and production in Europe is seriously needed. European agriculture has suffered for too long reduced attention (save largely for the CAP) of the European institutions and the rejection of the public as attacks on this activity by NGOs and other parties (environmental footprint, pesticides, use of water, cost of the CAP, unfair competitive advantages over producers from the developing world, etc.) have gone largely and irresponsibly without response, with an unintentional complicity that has led many Europeans to think of agriculture as an unnecessary and almost noxious activity whose products we can simply and happily buy elsewhere in the world at an overall lower cost (environmentally, financially, etc.).

The sector does not have, of its own, the energy or the resources to drive the changes and innovation that are needed. This will require leadership, courage and investments by the European and national public institutions as well as by the private sector.

Innovation today

3. Practical, on the ground innovation in agriculture in Europe comes to a large extent from the private sector (seed companies, equipment manufacturers, plant protection companies, etc.). A tight association and collaboration between public institutions (universities, research institutes, etc.) and the public sector is imperative if indeed Europe wishes to have a competitive and reasonably self sufficient agricultural sector.

Obstacles to innovation

4. Innovation is hindered by limited resources devoted to applied R&D, a dilution of efforts (proliferation of projects and research institutions, some without productive critical mass), and insufficient communication between institutions and the agricultural sector.

Demographic structure of the sector

5. The agricultural sector is certainly aged, as young people choose not to stay on, now that they have access to higher education and dwell in the dream of better and richer lives ahead in alternative activities. Agriculture is seen, rightly or wrongly, as a nostalgic dying activity of times long past in our part of the world, one in which with the exception of large, modern, automated and mechanized landholdings and consortia, is not possible to provide for a reasonably comfortable material present, let alone an attractive future for the heirs of this world of the past. Much more so in a country where average farm size makes it impossible to provide the kind of income that 21st century citizens demand and expect. A very large proportion of Spanish farmers are part time farmers, those who still feel some attachment to the land of their ancestors, but not as a truly economic, productive and entrepreneurial activity.

And naturally, older farmers are less open to change, innovation, new agricultural technologies, new approaches to marketing their goods, etc. Not to mention that while in the past science and its innovations were a beacon for prosperity, scientific and technological innovations and developments are now often suspect, spurred by irrational fears and tarnished by the idea that profit is the driver. Transgenic crops are a good example. The public also needs to be educated.

Future challenges driving innovation forward

6. The greatest challenge in Europe on this front is to return agriculture to its rightful place in the minds and the concerns of the public and decision makers, and insure that this activity remains as a vital component of what Europe needs to get right to insure its future. Return to agriculture the value and appreciation it once had among Europeans. Europe has become a prosperous and rich urban society, where we take for granted a number of things, among them, an ample, varied and even exquisite supply of cheap food. This mentality has to change.

The challenge will be driven by the realization that food shortages may occur and that Europe needs to be more efficient and competitive in food production (in terms on return on investment, environmental impact, competitiveness, etc. not just in yield/Ha). European institutions should be more proactive in increasing Europeans' awareness on this front.

Knowledge and innovation systems

7. Cooperation between the private sector and public institutions is a prerequisite for successful and fruitful innovation efforts. Greater incorporation of private sector needs, interests, propositions, etc. into the public decision making process in order to spur the type of innovation in agriculture that Europe needs.

Research and Development

8. While the role of government in defining national and European research priorities is obligatory, the role of local inputs and the contributions of directly concerned stakeholders into the definition of research needs and priorities are critical, as local are, in many cases, the needs for innovation. Particularly given the singularities and uniqueness of Spanish agriculture.

Official institutions must clearly provide funding for research but innovation in agriculture requires the financial commitment and contributions of the private sector, not only to make greater resources available but also to help maintain efforts in innovation within a practical and realistic scope and focus.

Education and skills

9. The level of education and skills of Spanish researchers in the agricultural sector is comparable to those of richer countries. An effort is needed, however, in fostering education of farmers and extension services. Institutions involved in agricultural research should reach out more for the end user, farmers and all links in the agricultural chain, intensifying their technology and information transfer activities.

Knowledge transfer

10. Research should have a greater practical inspiration, more oriented to resolving current practical problems that have direct economic impact, now and in the future. A greater integration between research institutions, extension services and the agricultural private sector is needed.

EU policies

11. The roles and objectives of the CAP and EU research efforts should be directed towards a greater overall efficiency and productivity of European agriculture for which research and innovation are a prerequisite. The Framework Programs are indeed a necessary tool, but perhaps insufficient. The amount dedicated in the FP to research in agriculture, fisheries, etc is of the order of 0.02% of the EU's GNP, 0.2% of the European budget and 4% of the total FP budget, which appears to be clearly insufficient. The challenges ahead of European agriculture require a greater financial effort.

September 2010

Oral evidence, 2 February 2011, Q 415-436

Evidence Session No. 11. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
The Earl of Dundee
Lord Giddens
Baroness Howarth of Breckland
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witnesses

Witnesses: **Marion Guillou**, [President, Institut National de la Recherche Agronomique],
and **Professor Douglas Kell**, [Chief Executive, Biotechnology and Biological Sciences
Research Council].

Q396 The Chairman: Well, Madame Guillou and Professor Kell, thank you very much for coming today. We are particularly grateful that you have come from Paris and we are delighted to see you. If I may, I will just deal with some formalities about the meeting. I think you have got in front of you a list of the interests that have been declared by Committee Members. This is a formal evidence-taking session of the Sub-Committee. Shorthand notes will be taken. They will go on the public record in printed form and on the Parliamentary website. We will of course send you a copy of the transcript and you will be able to revise it in terms of minor errors. The session is on the record: it is being broadcast live and will be subsequently available on the parliamentary website. I wonder if we could ask each of you in turn, possibly starting with Madame Guillou, to give your name and some comments about your organisation and responsibilities. Thank you.

Marion Guillou: My Lord Chairman, I would like to thank the Committee for inviting me. My contribution in this debate is as the CEO and President of the French National Institute for Agricultural Research. In fact, INRA, as a main aim, works on agriculture, food and environment in the scope of what we call the knowledge-based bio-economy, KBBE. It is a targeted research public institution. It employs 8,500 full-tenure members of staff and has a net income of €780 million. In fact, INRA is today the second largest agricultural research

body in the world by the number of its scientific publications in agricultural, plant and animal sciences. I am also currently the chair of the JPI, the Joint Programming Initiative, in agriculture, food security and climate change, and maybe we will talk again about that. I would like to ask for a favour: I have someone here to help translate just in case that becomes necessary, so it should not be, I hope, but would that be a problem?

The Chairman: No problem at all.

Marion Guillou: Thank you.

Q397 The Chairman: Thank you. Professor Kell?

Professor Douglas Kell: Thanks very much indeed, my Lord Chairman. I too am delighted to be able to give evidence before your committee and have these discussions. I am Chief Executive Officer of the Biotechnology and Biological Sciences Research Council, and I am also a professor at the University of Manchester. BBSRC is one of seven research councils represented in Research Councils UK. We spend around £470 million a year on research in biotechnology and biological sciences. The UK is number one in the world in biology, in contrast with some other subjects, where we are often number two, and we also have eminence in farming, as evidenced, for instance, by wheat yields in the UK, which are greater than in any other part of the world. We have strong relationships with international funding bodies, including INRA. We have strong commitments to engage with the public and other end-users or interested parties for our research and, of particular relevance here, we are leading a multi-agency, multi-research council, multi-government-department initiative on global food security, which I am sure we will touch on later. Of course we are towards the upstream end of science, and there are many interesting science drivers that I think we will also touch on when it comes to innovation.

Q398 The Chairman: Thank you both very much. Just as a matter of procedure, I think you know that there is a series of questions. They are obviously addressed to both of you and, if we can take them in turn, that would be good. Perhaps if we could start with the JPI, Madame Guillou, you referred to it and I think we heard about this from the Commission's DG Research and from the UK's Department for Business, Innovation and Skills. I think what we want to hear from you two, if we can, is two questions: how did the proposal for the JPI come about? Who identified the need to do research on these themes and how did it emerge? Secondly, how will it go forward from here and how do you see that happening?

Marion Guillou: So, maybe the European Commission already told you about the 2007 paper and the 2008 paper. I will start from the elements I have witnessed. From July 2008, during the French presidency of the EU, there was an informal meeting in Versailles of the Ministers of research and, at this meeting there were workshops on potential joint programming themes that were organised, including one—and I was co-chairing this one—on agriculture and climate change. At the time, it was the French presidency, and the next presidency was the Swedish one, so we were co-chairing the workshop, and we concluded, in fact, because many countries were interested by that theme, that it should be a theme for joint programming. At the time, food security was not involved in this workshop, and it was afterwards, because British colleagues said that food security was a priority for them, that we included food security in the JPI, so it became a JPI on agriculture, food security and climate change. Today, in fact, there are 20 members in this JPI, from the European Union

and outside the European Union. Well, there is another JPI in a complementary field; in fact, INRA is a member of the governing board of the JPI that is called Healthy Diet for a Healthy Life, led by the Netherlands, and it is focused on diet-related diseases. So, that is the real story of how we decided to get involved in this JPI. In fact, it was a decision by the Government, but the research organisations were involved from the first meeting.

The Chairman: Thank you.

Professor Douglas Kell: So, we absolutely recognise that there is value to be had in collaborative research, because that means you can bring together the best minds and the best laboratories in the world—or, in this case, Europe—to tackle the sort of complex and multidisciplinary problems that agriculture and global food security represent, so there is a strong recognition that the whole is likely to be greater than the sum of the parts when we do this. As Madame Guillou said, independently we recognise that areas such as global food security, industrial biotechnology and bio-energy, and research on health and wellbeing in an ageing society, are the key strategic challenges facing society as part of the knowledge-based bio-economy, which is recognised as being worth €1.5 trillion to €2 trillion in Europe alone, and worth 22 million jobs.

So, we have a very consensual thinking about this, and we are not starting with a blank sheet of paper, because there are existing programmes where we have equivalent collaborative activities called ERA-Nets—European Research Area Networks. The first one was one in plant genomics, and that has been very successful, and there are plans being made for a follow-up, essentially, of that, which will be called ERA-CAPS, which stands for Coordinated Action in Plant Sciences, and that will actually include the USA and New Zealand, probably—obviously not European countries. We think it is a continuing process of collaborative research activities that will contribute to the JPI.

Q399 The Chairman: What do you think the outcomes will be?

Marion Guillou: Indeed, there are several kinds of outcomes. First, we have organised the JPI during this first year, and it was quite fruitful, because a governing board has been decided, a scientific advisory board has been put in place. In fact, we have decided to have a working group to start pilot actions that will be short-term actions. Yesterday, in Oslo, it was decided which action we could start in 2011. On top of that, in fact, I think we can say we have built up trust among the partners, because it is a group of 20, so it is not easy. We are planning the first practical action that will start very soon, and maybe it is interesting for you to know that it will be an action about the risk assessment of climate change for European agriculture, with models, and the effect of climate variability on the regional farming system through all the countries that belong to that pilot action. This action will be the European part of an international project that is called AgMIP. AgMIP, in fact, is coordinated by Columbia University, and it will issue contributions for the IPCC working groups. We will bring the modelisation part linking climate change and the practical agricultural systems in Europe, and it will be an input for the world-level discussions.

Q400 Baroness Howarth of Breckland: Just a small clarification: your scientific advisory board, I noticed, had two members from the US, but do you have a member from the UK, and how is that put together? If you do not have a member from the UK, how does that

ensure that there is connection with the countries that are not on the scientific advisory board?

Marion Guillou: The governing board, in fact, represents all the members, and within the governing board, of course, UK is an important member—a different member—because the coordination of the JPI is done by BBSRC and INRA. So, in fact, we are the managing countries of the JPI. The scientific advisory board has been put in place in a different way. We asked each Member State to propose highly qualified scientists, whatever country they come from. In this way, we made a list of very highly qualified scientists and then there was a vote between the Member States. So the 12 members are the ones that were elected from that list. In the governing board you have representation of all the members of the JPI; in the scientific advisory board, they represent nobody except themselves and what they know about the topic.

Q401 Lord Giddens: Good morning, and let me add my welcome to that of the Chairman. Thanks very much for coming here. I have got a couple of questions about the EU Research Framework Programme. The Seventh Framework Programme has a budget of some €53 billion, of which just under €2 billion is allocated to food, agriculture and biotechnology. What is your view of the usefulness of research supported by the EU, and what might be done to improve its utility? Is it properly targeted? Does the fact that you have this JPI mean that the European Framework is not really working?

Marion Guillou: The two of us will have to answer your question. We cannot achieve European goals without agriculture—maybe we share that conviction—and without a renewal in agricultural systems, so innovation is essential. At the moment, the Framework Programmes promote networks between research teams through Europe. INRA, for instance, participates in 110 projects funded by the European Union. A good example is the wheat programme, because, as you know, wheat is very important through Europe and, in fact, we are involved—when I say “we”, that means BBSRC, INRA, but many others—in sequencing the wheat genome, because improving wheat for the ecological conditions of Europe is very important. You know there are diseases and we need to have a high productivity. In fact, the European approach is very important to pool resources to attain critical mass, especially when a multidisciplinary approach is necessary.

The Green Paper on the European Research Area highlighted the need for world-class infrastructures and, as you know, they are very expensive, and so it is very useful. I can give you a few examples of infrastructure that we share now: ANAEE is a network of environmental observatories, because we have different ecological conditions throughout Europe; MIRRI is a microbial resource centre, so that we share the genetic resources through Europe. Those kind of initiatives—there are others on animal health—are very important, because we pool very expensive equipment.

We feel it is very important that the EU continues funding agricultural research because it is a vast area and, at the moment, I am convinced the funding is clearly insufficient. I will give you examples: for instance, in the health domain, many projects get funding of €12 million, and several projects may be funded on one topic. In our area—I mean the food, agriculture and environment area—most projects have a maximum of €3 million, and there is only one project for each topic. It is just that the selection then is more difficult. The underfunding of agriculture is especially true, given its central role in addressing the challenges of food security and the need to build the European bio-economy. Of course, we would like to see

this funding strengthened in the FP8 to better reflect the central role of agriculture in European research.

We are in favour of an approach in the FP8 that would be based on the grand challenges of our societies, in contrast to the current thematic approach. We feel this will strengthen the research-to-innovation links. I will give you an example: a recent programme just started on animal change to improve the way to practise animal production without too much gas emission.

Professor Douglas Kell: As Madame Guillou says, and as we have said before, what the EU funds—

Baroness Howarth of Breckland: Chairman, could you just ask if Professor Kell could raise his voice? Do not be deceived by the PA system. Your voice is not really carrying too well this way.

Professor Douglas Kell: I am sorry. I will speak a little louder. I am so sorry. We very much see a complementarity between what the EU funds and the national research programmes, as we have said before, so we are very comfortable with that. In some ways, Europe has actually been quite in the lead in promoting the concept of the knowledge-based bio-economy, bringing together the capture of photosynthetic energy for biomass production for both edible and non-edible crops, and then subsequently the turning of the particularly non-edible crops into chemicals using so-called white biotechnology. Bringing those two aspects together, Europe has been quite in the lead at that, and the KBBE had €1.7 billion pumped into it last September, and that would seem to be a good starting point for the discussions for the Framework Programme 8 negotiations.

In addition, I would also support exactly what Madame Guillou said about the desirability of changing from a discipline-based approach that has largely been the hallmark of FP7 to a more global, grand-challenge approach that we think would be a better way of organising the research under FP8. So that is what I have to say about that. Then the ANAEE that Madame Guillou mentioned, the UK is part of that platform.

Q402 Lord Giddens: In other words, you think they integrate quite well.

Professor Douglas Kell: Yes, and typically, of course, the same actors are involved in both of these things, so people can integrate the research that they do accordingly.

Q403 Lord Giddens: I just would like to try a question on Madame Guillou, which is not down on our formal list of questions. I wonder if it is at all possible for you to comment on different attitudes between France and the UK in terms of rural preservation and attitudes to rural development. I do not know if you are able to do that. Please, if you are not able to do it, just ignore it.

Marion Guillou: It is a very important question, but it is a very difficult one, because you have a cultural aspect in the relationship to the rural areas, you have a physical difference, and so it is difficult to answer you within a few words. Would you accept that, given the importance of your question, I answer by a written note?

Lord Giddens: Of course, yes. That would be very useful, if you wouldn't mind doing that.

Marion Guillou: Because it is really a very wide and important topic.

Q404 Lord Giddens: I think it is a big issue to us because I think, when you are looking on the European level, you do need to look at these differences. I think different countries need to understand convergent and divergent attitudes that they might have to what seem on the face of it to be similar issues but, as you say, when you have a different cultural context or other aspects in the milieu that are different, then I think it would be worth it, if you could.

Marion Guillou: It is very important, but what I could mention briefly is that I think that it is not a static situation; I know the British situation just by reading so I am not as informed as on the French situation, of course, but on the French situation I can tell you that there is a big evolution. If I talk of my generation, we almost all had a relationship with farmers, or with rural areas, and an effective link with rural life. Of course, with 80-something percent of people living in towns now in France, you cannot say that of the new generations, I will answer by a note on the comparison between your country and France, but I have to tell you that it changes, so there is a dynamic to this relationship.

Lord Giddens: Thank you. That would be very useful.

Q405 Baroness Sharp of Guildford: Can I also welcome you and say thank you very much for coming? A year ago, as a Committee, we published a report on EU agriculture and forestry, and its relationship to climate change. In some senses, it was a bit of a preliminary report and it certainly awakened us to the need for research in these areas. But one of the things that we identified as being very important was that the research that was undertaken was translated into actions for farmers and foresters to carry through, and we felt that it was very important also that the research should be translated into practical and relevant issues. So, from the perspective of your organisations, what importance do you place in ensuring that there is a pipeline that transmits research findings into practical applications? What role do you see for the EU in this process? Should the Framework Programme have some translational aspects to it? How far would you see that we could develop a farm-advisory system under the CAP as a conduit for disseminating research findings?

Professor Douglas Kell: We certainly place considerable importance on the translational agenda, and the evidence for that is the many schemes we have in place that are designed exactly to interface the upstream research that we largely sponsor with the translational stuff. I have given you in the transcript some web-links to the strategic plan and the delivery plan, where we set out some of these, especially section three of the delivery plan, which explains how the Comprehensive Spending Review settlement will be helpful in this way. We also have a new and specific policy on knowledge exchange and commercialisation; again, I will provide a web-link, and BBSRC is actually the lead for the whole RCUK policy in that. Of our seven agricultural research institutes, they are all judged exactly on their ability to perform knowledge exchange and commercialisation, which influences how much money they get, which is normally sufficient to effect that.

Something I would like to mention, which is sometimes not seen as part of this programme, is the importance of the open-access agenda, which is making scientific literature and data available freely to everyone, because when that happens this makes translation considerably easier than if stuff is hidden away just in journals. Clearly, the web is going to be a very important means of dissemination.

Amongst the schemes that we have for promoting translation, I would mention Industrial Partnership Awards, which involve an industrial or user partner in a scientific research programme from the outset, involving them putting some real money in, so again it really makes it serious; link schemes; research technology clubs, we are quite keen on, where we bring together a modicum of companies—typically 10 to 20—who are interested in strategic underpinning of research, put some money into a pot, which we add to, and they guide the direction of travel. A recent one we had is the Crop Improvement Research Club, which is promoting innovation in particularly barley, oilseed rape and wheat, and that will have a budget of £6 million. 13 companies have joined that particular party. We have collaborative programmes with the Technology Strategy Board, in particular an Agri-Food Innovation Platform that has a budget of about £90 million over five years, and that is also with Defra, us and the TSB, and that has already given out about £50 million in research grants.

I should also recognise that part of our translational agenda comes from the provision of skilled-person power, and that is a major output of all of the research councils' activity. As well as the more conventional kind of high-level PhD graduates, we have recently initiated something called the Advanced Training Partnerships, which came out of Sir John Beddington's Food Research Partnership skills subgroup, and that will be spending about £15 million on a different kind of training that is going to be guided, as the Advanced Training Partnership name suggests, by collaborations between user groups as well as research providers, and we will be announcing the winners of that in the spring.

In addition, we also fund about 65 research experience placements to undergraduates in agricultural colleges and vet schools, which we think also helps translate. Finally, all of our institutes specifically have outreach programmes that, again, they get judged on, and one example I could give is the Rothamsted Research Association that concentrates on arable crops and has, I think, a couple of hundred members, and its strap-line says it is for "driving science into the field". With all of that, we very much can claim we recognise the importance of the translational agenda and are very much putting it in place.

Q406 Baroness Sharp of Guildford: Could I interrupt you at this point and just say that some of the evidence that we have received has, so to speak, referred to the work that you do as being perhaps to too great an extent blue skies research. You are linking up with industrial partnerships and so forth, and we acknowledge, and as you also point out, it is also through training people. This goes to the companies who are working in these fields—the seed companies and so forth—and they do a lot of outreach work with farmers, but what in the UK we have lost is the old ADAS service that, to some extent, carried the message through. If you think of farmers as being the small and medium-sized enterprises, the difficulty is really, if we are to move to this concept of sustainable intensification of farming, are we getting the messages to those who are actually farmers, who, to some extent, have some scepticism sometimes about the information that they get from industrial partners, which obviously is to their advantage rather than necessarily to the users' advantage?

Professor Douglas Kell: I think I would say the answer is it works in part. When ADAS ceased to be what it used to be, to some degree, there was not market failure in that there was a recognition of the need for this, and commercial companies set themselves up. They were not themselves the industries, but they were the sort of interlocutors and the brokers, and especially, I think, in the large arable sector, this has worked pretty effectively. It certainly is not true of a Welsh hill-farmer or something like that, so there are areas where this kind of dissemination probably is not going on as effectively as one would like, and that is

clearly something that needs to be looked at. To your question about when people start looking at CAP reform, and whether we would look to a third stream of funding that might fund that kind of thing, we feel that would be a good way to look at things. The National Farmers Union, I think, has a similar kind of view and, when those discussions are going on, we would welcome consideration being given to taking those kind of extension services from CAP reform money.

Q407 Baroness Sharp of Guildford: Yes. Perhaps, Madame Guillou, you could give us some indication of the degree to which extension services remain, I believe, with the INRA agenda.

Marion Guillou: Yes. Of course, you know the French system is quite different, because we still have some extension services by kind of products and on a local basis—I mean on a territorial basis. I agree that we need change in the system because, in fact, we are talking about sustainable intensification, so it means an evolution of the system. We are building very different ways of working at the moment. That is what I could call as I specialised in engineering, so maybe you will allow me that expression—a “knowledge exchanger”; that is to say, it is not only that the researchers produce knowledge that is transferred afterwards. Now, we think that we have to discuss the topics we put in priority with the stakeholders. It could be the farmers, the seed companies and the NGOs—all the stakeholders—so we have to discuss the priorities first.

Then we try to build—when I say “try to build” it is because it is quite new, so do not ask me whether it will be successful—I hope so, but we will have to meet within a few years. We built new ways of working in those “knowledge exchangers”; that is to say, farmers contribute some innovation they have found on the ground, so that they can be criticised, to see what is generic, whether it works in different conditions. As you know, science is about genericity sometimes, and so experimenting in a place does not mean that it will work in other places. We have built a group for “agronomic re-launching”. It means that we will work with the teaching system in France, with the extension system in France, and with the research system, and then, topic by topic, we will see what are the priorities; for instance, for integrated pest management for vegetables at the moment. I do not know whether it is a problem in the UK, but for vegetables, because of pesticide limits and withdrawal of certain products because it is too expensive to apply for an authorisation, you have orphan diseases. I can give you practical examples but I am sure it is not the level you are interested in—it is the principle. We have built this system so that farmers tell us what they have found, researchers tell the farmers where they are, and together they choose the questions they will work on, and together with the extension services, specialised on vegetables, for instance.

More or less what, at the moment, we are building is a more global approach, a more systemic approach. Of course, if you just look at the disease and the pesticides, you need to take a relatively simple, technical approach. Now, if you do not have the pesticide, you have to rethink the global system: with genetics; with agronomy; with the mosaic in the landscape, because, of course, you know that the pests have certain dynamics depending on the landscape; with the economy, because, of course, you cannot ask a farmer to adopt practices that would not be economic. You need social sciences, because some of the practices have to change, and adoption of different practices is not obvious. So we try to build this systemic approach and, at the moment, we have a group on vegetable pest integrated management, a group on crops integrated management, and a group on animal breeding

integrated management. We have to renew the way to work, because sustainable intensification is not obvious at all. We need to be competitive and environmentally friendly, and both of them are quite a difficult challenge.

On top of that, I will share a conviction with you: for productivity, the farmers know the link between what they do and the results. It is obvious: farmers see that they have more output. For the environment, farmers have no evidence of the effect of different practices, so you need to have some indicators that are usually more global than the individual level. It is not just one farm that will make the difference. Of course, for greenhouse gas systems, how could a farmer see the difference between different practices? So, if you want to have sustainable intensification, you need to have a technical system beside the individual farmer. It needs to be at a different scale and with different competencies, so that you see the difference in effect of the practices. Well, I do not know whether you share that conviction that we need to change all the system.

Q408 Baroness Sharp of Guildford: No, I think we very much share that conviction, and we are interested in what is going ahead. Some of this is going ahead in Britain too. We have got some of the sort of real-life experimentation going on, but I think not as much in a systematic way. Am I right?

Professor Douglas Kell: Yes, I think that is fair.

Q409 The Earl of Dundee: To what extent do you think that public opinion should drive research into food?

Professor Douglas Kell: We consider it to be very important that research funders and researchers maintain public confidence in research in general, and their research in particular, and one way to do that is to ensure that we take account of public opinion and aspirations. Do I think that public opinion should drive research? I do not think I can say that. We like to think that it should be a dialogue rather than any directional driving, and actually we have had a number of very successful dialogues that have proved the value of this approach to engaging public opinion; for instance, in stem cells, which we have done with the Medical Research Council, and on synthetic biology, which we are doing with the Engineering and Physical Sciences Research Council. Public opinion helps frame the important research questions such that the research can be done to provide some evidence on which the public opinion might be formed or modified and advanced.

Clearly, the specific decisions on research investments are left to experts, but the way we organise this is that the experts apply their expertise with the full awareness of public opinion. Now, as a member of the public as well as the Research Council's Chief Executive, I also have views and they are fairly straightforward. The really important one I would like to put is that I think that regulation of what we make must be done on the basis of the traits that it has, and not on the basis of how those traits were provided. Obviously, that bears on the question of genetic modification. That has been the basis for regulation of all microbial products since the start of recombinant DNA, when people started producing things like insulin that diabetics have been injecting into themselves for 20-plus years.

I also believe very much that consumers should be able to have the choice as to what they buy, but if the stuff is not available then clearly that choice cannot be exercised. Clearly, that also hinges on public opinion as to what may or may not be grown in a country at a

particular time. Both the Royal Society report, *Reaping the benefits*, led by Sir David Baulcombe, and the recent, rather comprehensive Global Food and Farming Foresight report that came out last week, have both stressed that we wish to have all kinds of tools available to us to develop the necessary sustainable intensification that is going to be required to fulfil the global food-security agenda, and I was actually a member of the high-level stakeholder group of the Foresight project. These include a lot of molecular tools, some of which involve genetic modification, others of which do not, which simply assess the molecular constitution of different kinds of plants and livestock.

I would also mention the purple-tomatoes project that came out of our John Innes Centre. This was a genetic modification that induced tomatoes to make health-giving compounds—anthocyanins—and these tomatoes were then fed to particular strains of mice that were prone to cancer, and they put 40 days on the lifetime of these mice. That is equivalent to 17 years on a human being. I think the public response to that was overwhelmingly positive; in fact, there would be a queue a mile long to get access to these tomatoes. Our own position on the use of, for instance, genetic modification in research is well established. It has been on the web—again I will provide a web-link for the transcript. The main points are that we must be able to use genetically modified tools to understand how organisms work and to work out what the potential is by which we can improve agricultural yields and all the desirable traits that I could have listed about disease resistance and yield enhancement, and all the things that will be the outcomes of the JPI and other projects. Because without being able to do these experiments, no evidence is going to be possible by which public opinion might have a firm basis.

Finally, one cannot fail to recognise that the EU has recently derogated the choice as to how genetically modified organisms will be able to be grown commercially to individual Member States, and that is something that is under active consideration inside Defra and elsewhere, I believe. We may expect some announcements in due time.

So, all of these things have been strongly influenced, of course, by the public's attitudes, with GM crops being the most obvious. From the innovation and economic-competitiveness point of view, it is clear that we have been rather hamstrung inside the EU by the existing legislation relative to that available in other countries, so I will stop there.

Q410 The Earl of Dundee: For identifying a good direction for agriculture and its R&D and then communicating such prescriptions to the public, what part do you think that the European Union has to play?

Professor Douglas Kell: The European Union certainly has a part to play and, indeed, it has been playing such a part. Our own organisation and RCUK has established that these dialogues are the best way to do this, and there is a fairly well established methodology that has been used for this. We spend £900,000 a year on Science in Society and, for instance, the Research Councils UK has £4 million on Beacons for Public Engagement. So we think all of these things are going to be important. The EU itself does this, obviously, at a rather higher level. Clearly, engagement tends to be a more local thing and it has to be cascaded down to be really effective. We also have a lot of public exhibitions including, presently, ones on stem cells and biodiversity, and we are often invited to contribute to the Royal Society's Summer Science Exhibition. Engaging with the public in the dissemination and judging of the research agenda is extremely crucial to us.

Q411 Baroness Howarth of Breckland: I find that interesting, comparing it with the evidence we have heard thus far from other witnesses, who give a very strong impression that public opinion is not moving, and certainly not moving as fast as we need it to move if we, in Europe, are going to move at the speed of, say, the United States in terms of intensification and development of GM crops and being able to move forward in the other areas of science. I just wondered who you thought really should be moving this forward. We have had people who thought the government should, that it is a combination of partnerships, but sitting next to a judge—that is something quite different—recently talking about some of this, which were quite different issues, he said, “I do not think we need GM crops.” Now, if you have got people of that level still unconvinced in communities at an intellectual level, how do you begin to get that message across? Because it certainly is not out there yet.

Professor Douglas Kell: Do you want to answer?

Marion Guillou: Well, maybe we share.

Professor Douglas Kell: Okay. Well, I can start. The questions of what you need and what you might wish to have access to do not have the same answer, so our position has always been that you want to have the opportunity to be able to do things; whether or not you choose to deploy them then becomes a regulatory matter. Yes, it is certainly true that you will hear these kinds of opinions, but I think our job is to try to ensure that the EU is well placed for the innovation agenda, both in food and non-food crops, such that, when the required increases in yields become manifest, we do not only then start trying to do something about it. So I think everyone has their part to play. I do think the dialogue will be rejoined fairly soon and I think there is a move in public opinion, based on desirable traits, because that, arguably, was what went wrong last time. The innovations that came in during the 1990s were seen as benefiting only the producers, not the consumers, and although there were other reasons why I think GM fell out of favour at the time, I think that was the chief one, and it is very clear that we are going to need to improve agricultural yields and disease resistance and all of these traits, and that GM is part of the toolbox—it does not have to be all of the toolbox. Much of the advances may be done by molecular tools such as marker-assisted breeding and so forth, that do not of themselves require GM production of crops, but use genetic knowledge to improve the traits. But some may, and there are some traits which it is hard to imagine you would be able to produce without using genetic modification.

Marion Guillou: I will add some comments. In fact, do we need GM? I would not answer such a question. Which GM? Which trait? What for? How do you make it? Which precautions do you take when you try it? And so on. My first answer to that judge would be to look at that, on a case-by-case basis. “GM in general” is a very dangerous obsession. What do you do with GM and how do you do it would be my first answer.

Then my second answer would be that, life sciences are really going very quickly at the moment. It is tremendous what they can achieve now. I am sure that the applications of life sciences will involve a lot of people. For me, it is really a necessity that social scientists and biological scientists work together, before going to the innovation, to understand the expectations of society, because when you talk about a risk and benefits approach, who benefits makes a difference for the people and for the perception of the public of the interest of such and such an innovation.

I would say it is very important at the moment to have interdisciplinary programmes, and if you are interested, there is a publication in PLoS in November about a social experiment we

put in place involving social scientists and plant scientists around a GM field trial. I do not know how it is in your country at the moment, but in France there are a lot of difficulties surrounding field trials. We wanted to trial a GM plant for resistance against a very bad disease. No other means to fight that disease existed at that time and so, as a research body, we thought it was our duty to trial that. In the greenhouse, it worked, and of course you know that, when you go outside, the diversity of the situations make it different. So we wanted to have a field trial—we thought it was our duty to try that outside—but we knew that, since this involved vines, it was a very symbolic plant for the public, and so we decided that we would make, at the same time, an experiment about a different way to work with the public. So social scientists got involved. We had an international committee to look after that, because some Dutch people had some experiments that were better than we were in that field, in the social sciences, so we involved Arie Rip and people from other countries to follow up the experiment. In fact, we tried to understand the questions the different publics asked of the experiment. Of course, our research was a plant-science one, but the questions the public ask are often significant. They are not the scientist's question, but they are significant and we can take them on board. Maybe that is a second conclusion I would draw from that; that is to say, the innovations are so quick that sometimes we have to be very careful to involve the public in the questions so that they follow what the science is doing, in a way—they are involved in the questions that the scientists put on the table.

My third remark would be that, of course, GM biotech is only a part of the green biotech. I do not know how quickly our populations will be ready to accept GM biotech, but we need genetic improvement to face the challenges that are coming; either GM biotech, if the public accept that, or other biotech, if GM is not accepted. The scientists won't be the people that answer that question. Whether the public will accept GM biotech or not is a difficult question. So we have to work to ensure that they understand better why we do that and how we do it, but we have to work at the same time on other biotech as selection assisted by markers for instance.

My fourth point is that, in those fields that are near-life we need to be very careful about the ethical side of it; we have an ethics committee. They helped us in formulating the questions and the methodology for animal-cloning, for GM, for intellectual property. Of course, intellectual property is a part of the question of GM, so I think it is very important that we take all that on board, but I share the conviction of Professor Kell that, we need dialogue, because we need to innovate.

Q412 The Earl of Dundee: Very interesting to hear what you say. Picking up Lady Howarth's theme, do you think on balance, perhaps, that our attitude towards this question is a little bit too imbalanced from the bottom up, rather than top down? Do you see there being perhaps a useful counterbalance being able to be provided by a European Union overview? I am just wondering if Lady Howarth's judge, who will have come to a very fair-minded conclusion as a result of the information available to him, would have come to slightly different conclusions if he had been apprised by more of a top-down, long-term overview, such as the European Union might be able to provide us with?

Professor Douglas Kell: I think there is certainly scope for that and I think some of that is starting. Last October, I attended a conference in Europe on the knowledge-based bio-economy, in which Madame Guillou was a speaker, as was Mrs Geoghegan-Quinn, the EU Commissioner, in which the direction of travel is clearly being set from a high level, and if the direction of travel is to include some of these things, I think this would be of value.

Certainly, the research agenda was being made very clear as to how we were going to deliver the knowledge-based bio-economy for Europe.

Q413 Lord Cameron of Dillington: Perhaps I could start by thanking Madame Guillou very much for the hospitality of INRA yesterday in Paris.

Marion Guillou: I was sorry not to be able to be there.

Q414 Lord Cameron of Dillington: So was I, but it is very good to see you here today, thank you very much. You have already, actually, answered my question, which was about agricultural extension. I agree with you when you said that, to some extent, the entrepreneurial farmer will always find productive increases and he could see the difference. He looks at other farms and sees it.

We have been discussing this morning climate change and the influence of agriculture on climate change and you did touch on it, but maybe you could expand. How are we going to get farmers to minimise their effect and their production of greenhouse gases in Europe? How are we going to get farmers to adopt the policy? It is about agricultural extension, but maybe you could expand a bit on that.

Marion Guillou: Of course, there are several answers to your question. First, we need to have the technical means, the technical solutions—I mean the improvements, the possibility to know which kind of feed, for instance, for the bovine population will make less methane emissions, so we need to experiment. We need research. We need to work on the rumen microbes so that we understand the links between the microbes and the feedstuff and so on. So, we need some research and we need new knowledge. That is the first part, maybe, of the answer, because those questions did not exist before, so we did not work on that. We worked on efficiency, we worked on health, we worked on animal welfare, but we have never worked to minimise methane emissions or nitrous oxide emissions, so it is a new kind of question where we need innovation.

Then, of course, we need to be very careful that, even if the technical answers are there, we need to make them practical so that they are possible for the farmers to adopt them: possible because of the knowledge, so that they get the information; possible because of the economy, because if it is less profitable, the farmer needs compensation. Maybe now we need to refer again to the CAP and the tools, the different incentives you can give to a farmer so that he practises something else. Professor Kell was talking about the non-food products, the farmers produce also some ecosystem services: biodiversity, quality of the water, carbon sequestration in the soil, some what we call public goods. If you do not give money for those public goods, then there is no incentive to take them into account.

You need as well to be careful about the sociology of the change because, of course—could I say that?—some practices are rewarding because it is common sense to know that, when you produce a successful wheat, it is rewarding because your neighbours see that you are efficient. Being effective when it is related to greenhouse gases, it needs some changes in the reward system, in a way—either economic rewards or regulatory incentives or pride, because you have done something useful and well done. So, you need all those elements.

Q415 Lord Cameron of Dillington: Or blackmail? You know, “You will not get your European support unless...”

Marion Guillou: That is the regulatory side of it. Blackmail is more negative, maybe. Yes, an obligation, because you do not get your incentive if you do not respect such and such rules. Of course, you need to work on all those elements, and what is very important in my view is that the scale of the positive effect is not the individual scale, and so it is very tricky, because if one farmer does it well, it is not enough to ensure that the quality of the water is good.

Q416 Lord Cameron of Dillington: Could I ask you a question: would it be practical for a programme whereby, either European or national, every farmer actually calculated what their carbon footprint was? It would be a good start, wouldn't it, and then farmers would compare. I mean every farmer would be different—completely different. It would be a very difficult paper form to work out, but there should be some system whereby you can work out. I do not know.

Marion Guillou: Yes, we are working on the footprint of the food system, and it is a very difficult question—you know about it—because it depends whether you take into account the inputs. Well, where do you go? Do you go to the potash place abroad?

Lord Cameron of Dillington: Yes, quite.

Marion Guillou: So, you have the question of the limit of the system, of course, but afterwards you can have some indicators. Of course, indicators will never be neutral. There is no absolute good indicator. It will be a construct of a social discussion, because, as I say, there is an arbitrary decision to which limit you go. So, you have to work on the footprint. You have to choose indicators that are socially constructed, if I may say so, so that people from different points of view accept those indicators, and then it would be a very good idea to follow up the indicators so that it gives an incentive to the people to agree on which progress: where you are at the moment, did you progress, and which positive actions you realised. I agree that we will need science-based indicators—science-based but socially discussed, because science will never be able to give a clear-cut answer if you do not choose the system you are looking at.

Professor Douglas Kell: I could echo everything that Madame Guillou says. Each of these is necessary. The technical means and the practical implementation are clearly going to be important. It is well recognised that the amount of carbon sequestered in the soil is actually twice the amount in the atmosphere already, so the ability of agriculture to improve carbon sequestration is potentially very great, but we have never used very deep roots as an agricultural trait. As Madame Guillou said before, we have always been tilting at different windmills and not environmental ones, but the technical ability to effect large-scale carbon sequestration, which will also improve nutrient usage, stop the nitrous oxide production, improve water retention, these are certainly desirable things.

We also need the cultural and social recognition that doing these things is going to be important and, therefore, we have to effect cultural change. Some of this can be done by regulatory means and incentives and financial instruments and, “If you plant this, we will give you x amount of pounds per hectare,” and so forth, and the recognition that ecosystem services are a significant part of what the rural economy provides.

I think the idea of the website from which you could calculate your carbon footprint from different means is excellent. There is something similar for a different kind of scale, and not largely including agriculture, on the Department for Energy and Climate Change's website that David Mackay, the Chief Scientist there, has put in place, and that has proved very helpful in getting people a) to think about it, but b) also to come up with some real numbers, a real evidence base, by which we can determine which practices are improving from the environmental point of view and which ones aren't, so I think that is a great idea to take that forward.

Q417 Baroness Howarth of Breckland: Professor Kell, in your evidence you mention the report that is going to be produced in March 2011, which is very pertinent to what we are discussing this morning, because it looks at delivering more effective knowledge transfer and translation of research outcomes and advice to practitioners. We just wondered if you could say anything about the findings of this project at this time—and tell us if it is an inappropriate question for us to ask, but we would be obviously very interested—and what are your views on how innovation in agriculture can be best promoted?

Professor Douglas Kell: Regarding the report that has been commissioned with Defra, unfortunately I cannot even give you very preliminary findings because they do not yet exist. What is happening, I can tell you, is that the first stages are involved in recognising what is going to be the most appropriate methodology to carry out this survey of how translation and knowledge-transfer is going to best happen in the agri-food sector, and that is being done via a series of interviews with knowledge-providers and users, and the literature review. Later this month, there is going to be a workshop specifically to challenge that, and then the second part is to choose a specific example, which is going to be the UK wheat supply chain and the value chain there. That is what is happening but I cannot really give you any outcomes at that stage.

As to how innovation in agriculture can best be promoted, in my academic life I am what is called a systems biologist, and that teaches you that, in order to change a system in a large way, you have to effect multiple parts of it simultaneously, so my opening gambit there is to recognise that it is going to require effecting multiple parts of what is a complex network simultaneously.

Now, obviously, as a research-council funder, much of our role is providing the knowledge that will make it possible to innovate because, without such knowledge, innovation becomes rather tricky. A very great part of the answer of how you effect this is to bring together all of the multiple funders and users to help the innovation chain, because keeping people separate in silos inhibits that process, so I am very clear about that. Again, as an existence proof, we have recognised that this is the way to do it in our global food security programme that we lead, which involves, as mentioned, five research councils and Government departments and the Scottish Government, and some others are potentially coming in to join us as well.

In a similar vein, we have been part of the Insect Pollinators Initiative, with Defra, the Wellcome Trust and the Natural Environment Research Council, and we are also part of, more globally, the Collaborative on Development Sciences, and have a number of programmes with the Department for International Development, all of these dreadful acronyms, SARID, which is Sustainable Agricultural Research for International Development, and CIDLID, which is Combating Infectious Diseases in Livestock for International Development. We have recently announced a new £20 million programme with DfID and

the Bill & Melinda Gates Foundation and the Indian Government, specifically to look at biotic and abiotic stresses. The idea of bringing together multiple actors to cover the whole value chain is, I think, an important part of how innovation is best going to be done.

But I would also make the comment that—and Madame Guillou made a similar remark—the changes in scientific knowledge that have recently come to the fore, for instance in genomics, do make innovation a much more rapid process than was possible in the past. Of course, I could speak of the internet and the web and dissemination. An example is that, in January 2009, the number of DNA bases in the DNA databank that had been sequenced over history was 200,000 million, which is quite a respectable number relative to the 3,000 million for one human genome. That is the number of DNA bases that are sequenced by one machine in one week now. That is the change in science drivers in that particular area alone, so capturing and recognising new methods is a very important part of the innovation agenda, and the result of all these kinds of things are large amounts of data—volumes of data that we have historically not had access to, all in digital format, all available on the web, and the necessary informatics infrastructure for dealing with those kinds of data and, indeed, disseminating them. If it takes a minute to move a gigabyte, which is the sort of thing you can have on a pen drive, it takes two years to move a petabyte and, at the moment, that is obviously going to be a bit tricky, and innovation in e-infrastructure, as we call it, is going to be important there. It is possibly not something you would have thought of in agriculture, but actually it is going to be very important to the whole of agriculture as well. I think I will stop there.

The Chairman: Well, I think I should say thank you on behalf of the Committee. I think it has been tremendously stimulating. I think you have taken us in certain directions we probably had not even anticipated, and I think some of the comments on the socialisation of science are very important. We are very grateful, and thank you very much, and have a safe journey back.

Professor Douglas Kell: Thank you very much, my Lord Chairman.

Marion Guillou: Thank you very much, my Lord Chairman.

Supplementary written evidence (INIA) (IEUA 37)

RURAL AREAS IN FRANCE AND THE UNITED KINGDOM: CONVERGENCE OF ISSUES AND MECHANISMS

Marion GUILLOU, President and CEO INRA

(24-Feb-11)

Contributor: Bertrand SCHMITT (Head of the “Social Sciences, Agriculture and Food, Rural Development and Environment” division at INRA)

If the presence of agricultural sector characterizes the rural areas especially in terms of land use, its declining weight in rural employment and population has been accompanied by significant changes in demographic, economic and social processes affecting these areas. The significant migration flows that support the rural population growth leads us to emphasize two key issues. The first relates to the improvement of a supply and accessibility of shops and services to populations scattered in those areas with low density. It is as much a matter of territorial equity as a lever for action to support economic development. The second issue concerns the reduction of social inequalities between rural and urban areas but also within those territories. Finally, several issues focusing on agriculture can be identified, relating to the environment, production of rural amenities, competition for land use or economic development based on agricultural and agri-food spheres.

In this note, we aim to describe the recent changes in French and English rural areas and show that, from these points of view, they differ very little. The differences that we could expect because of the differences of agricultural and rural history between both countries tend to disappear.

1. Rural population growth: urban sprawl or counter-urbanization?

Whatever the statistical definition of rural areas we used (see box), the rural population growth following a long period of rural depopulation is now clearly confirmed in all developed countries, including the United Kingdom and France. This demographic reversal affected very early the United- Kingdom where it was seen as early as 1951; in France it began later, in the early 1980s. It was originally described in the French case only as a movement of urban sprawl, the demographic change firstly affects rural areas located close to the outskirts of urban centers. In the UK, it is considered as a phenomenon of counter-urbanization because population tend to grow faster in more remote rural areas. A debate between these two forms of rural dynamics emerged and sought explanations in the trajectories of urbanization, rural development and the relation to agriculture that each country developed in the 19th and 20th centuries (see, for example, H. Buller, 1991, or A. Champion, 1994).

This opposition largely disappears today since rural population growth in both France and the United Kingdom concerns all categories of rural areas, whatever their location near urban centers or further afield. Thus, between 1999 and 2006, the annual rate of population change in the French municipalities belonging to the predominantly rural areas is now greater than that of urban centers (+0.7% / year vs. +0.5% / year), while the periurban

municipalities exhibits a rate of +1.3% / year, similar to that of the previous period (+1.2% / year between 1982 and 1999). Similarly, in England, the latest population estimates show that between 2001 and 2008, population growth has been faster in rural areas than in urban ones, with particularly high levels in Sparse Town & fringes (+5.3%) and Less Sparse Villages, Hamlets & Isolated Dwellings (+6.1%).

These recent developments reduce the differences between both countries in terms of rural dynamics. A convergence towards a similar demographic turnaround benefiting all types of rural areas suggests, as noted by Le Bras (2007), that the difference between urban sprawl and counter-urbanization can be interpreted as different steps in the settlement reached by countries and depending on the location of economic activity and transport networks. Periurbanization and urban sprawl thus appeared earlier in the United Kingdom than in France and the rural spread of population growth in the whole territory, as seen through counter-urbanization, now concerns both countries.

Box: Definition(s) of rural areas.

Beyond the conceptual debates on the relevance of distinguishing urban and rural areas, statisticians and analysts need to rely on precise definitions, however, they vary greatly from one country to another.

In France, the distinction between urban and rural municipalities is historically based on the threshold of 2,000 inhabitants of agglomerated population. This definition, somewhat perfunctory, was completed by combining a classification based on employment agglomeration and intercommunal commuting flows. This Delineation in urban areas and in areas of rural employment (i.e., ZAUER) distinguishes: (i) the urban centers, urban units greater than 5,000 jobs, which account for 60% of the population on 8% of the territory, (ii) periurban municipalities, where at least 40% of active residents work in urban centers and where live 22% of the French population over a third of the territory, (iii) the predominantly rural areas, which consists of all other municipalities, on which 18% of the population resides on almost 60% of the territory.

In Great Britain, the split between urban and rural areas stood at 10,000 inhabitants and the current classifications are based on two levels. At the finest level (Census Output Areas, COAs), the classification combines morphological characteristics (urban areas, towns, villages, hamlets and scattered dwellings) and the more or less dispersed context. It distinguishes eight categories: two urban ones (Sparse or Less Sparse Urban areas) and six rural ones (Sparse or Less Sparse Towns & fringe; Village in Sparse or Less Sparse context, Hamlet & Isolated Dwellings in Sparse or Less Sparse context). At a more aggregated level (Local Authorities Districts LADs), the classification identifies three categories of urban areas: Major Urban (districts of more than 100,000 or having more than half of its population belonging to an area of over 750,000 inhabitants), Large Urban (districts with between 50,000 and 100,000 inhabitants or with more than half of the population belonging to an area comprising between 250,000 and 750,000 inhabitants) and Other Urban; and, three categories of rural areas: Significant Rural (between 26 and 50% their population living in rural COAs), Rural-50 (between 50 and 80% of their population living in rural COAs), Rural-80 (over 80% of their population living in rural COAs). English rural areas thus cover 86% of the territory and are home to nearly 20% of the population, with half of this population living within 6 miles around town of over 30,000 inhabitants.

Despite these differences in definition, we consider here as urban the French Urban Centers and the British Urban Areas and the other as rural areas. The distinction between rural

areas under urban influence and those which are further away rely on: for France, the break between periurban municipalities and predominantly rural areas and for the UK, on the distinction between Sparse and Less Sparse COAs on one hand and on the other hand on the gradient of rurality included in the following categories: Significant Rural, Rural-50 and Rural-80 LADs.

In both countries, low population growth in urban areas is the result of a very large negative net migration more than offset by a largely positive natural increase. Conversely, rural areas combine an excess of immigration and a positive natural balance when they are close to cities, while in remote rural areas, these migratory flows are partly offset by an unfavourable natural balance by an excess of deaths over births. Thus it is the reversal of certain migratory flows that supports rural population growth. Two outflows from urban areas are particularly striking. The first is young couples with children who feed the flow of periurbanization. Unable to satisfy in urban areas their demand for housing due to the increase in housing prices with increasing densities, they choose to relocate in areas that combine affordable housing costs, accessibility to employment and availability of services and "natural" amenities. However, the accessibility costs increase with distance, such that their residential location is "forced" to rural areas close to urban areas where jobs are concentrated. The second type of migration flows concerns older people who, when they transition into retirement, reconsider their residential location. The loosening of ties to employment allows them to choose more remote rural areas with lower housing costs and higher rural amenities. The emergence of these urban emigration flows tends to mask the persistence of a continuing rural exodus. The latter mainly affects the young rural (or periurban) population, especially the most educated. They tend to leave their birth places to settle in urban areas that are more active in terms of access to job market or/and access to higher education.

2. An elderly rural population with a low level of qualification

These population movements have important consequences on the social composition of the rural population. Firstly, the departure of rural youth and the arrival of people at retirement age lead to a strengthening of the aging rural population. In England, the median age of rural populations is significantly higher than urban populations (44.4 years against 38.5 years in 2006) and the older population (65 years and over for men and 60 and more for women) weight almost one quarter of the English rural population versus 18% in urban areas (CRC, 2010). This figure even approaches 30% in Sparse rural areas. Furthermore, the departure of (young) skilled people involves the persistence of a low skill level of the rural workforce, although this trend is offset, particularly in the United Kingdom, with the arrival of some skilled persons. If the size of the farming population is now equally low in both countries (about 2.5% of the total workforce), the share of unskilled workers in the non-agricultural labour force in France is almost twice as high in the predominantly rural areas (18%) than elsewhere (10%). In return, skilled workers concentrate in cities: the proportion of managers is 2 times higher in urban than in rural areas.

These changes in the social composition of rural areas lead to important differentiation in wealth and income between the types of areas. In both countries, the income gap between urban, rural areas near cities and more remote rural areas are rather unfavourable to the French predominantly rural areas and English Sparse rural areas. They are favourable to peri-urban and less sparse rural area populations. Thus, in the case of England, the median income

(after housing costs) is estimated in 2007-2008 at £ 17,200, £ 19,200 and £ 16,500 respectively in urban areas, Less sparse and sparse rural areas (CRC, 2010). Beyond these median figures, there is a social bipolarization in remote rural areas (coexistence of rich or middle class retirees, poor agricultural pensioners and poor unskilled workers) and in urban areas (middle class or higher employees in urban downtowns versus a socially precarious population in some suburbs). Only the peri-urban areas (in France) or less sparse rural areas (in the UK) are characterized by relative social homogeneity around middle-class commuters, who tend to be well off. The issue of territorial cohesion, reducing inequality between urban and more or less remote rural areas intersects with an issue of internal social cohesion within each category.

3. Rural economic growth mainly based on the residential dimension of economic activities

While urban sprawl and counter-urbanization mainly concern the population (whether active or retired), the concentration of jobs in urban centres is greater than that of the population. Thus, in Great Britain, over 80% of jobs are concentrated in urban areas, what, combined with lower labour productivity in rural areas, implies an urban contribution to the national GDP of around 86% in 2007. In France, urban concentration of employment is lower with 71% of jobs located in urban centres. The urban agglomeration of economic activities is obviously the result of industrialization history and of economic forces of agglomeration. However, we observe a recent movement of rural employment growth with, in France, a very fast pace in peri-urban areas, reduced in the predominantly rural areas by the on-going decline in agricultural employment. In the UK, the recent economic regression has less severely affected English rural areas, where employment has continued to grow by 1.3% between the 2nd quarter 2008 and the 4th quarter 2009, than urban areas, where employment fell by 2.3% over the same period.

Agricultural sector accounts for a small share of employment, whether in English (7.5%) or French (12.2%) rural areas. The decline in agricultural employment was earlier in Britain than in France where later and slower industrialization has maintained a link to the land of an important part of the workforce.

In a context of declining jobs in manufacturing sectors and of growth of service employment, rural employment is characterized by a strong prevalence of jobs in shops and services for people (well over 50% of rural employment in both countries) and an overrepresentation in manufacturing sectors. In contrast, jobs in business services and superior services continue to grow and to concentrate in urban areas. The sectorial distribution of economic activity shows the today's dominance of a "residential" rural economy, linked to population growth and development of recreation and tourism activities in rural areas. Rural economic development is then more dependent on the emergence of this residential and recreational economy than on the traditional drivers, induced by primary or secondary basic activities. This mechanism, noted in peri-urban areas, also concerns more remote rural areas. However, in France it is more significantly associated with public services (education, health and social services and administration) than with private services (commerce and services to individuals), while in Great Britain, it is carried out by private services.

In both France and the United Kingdom, one of the key issues of development of rural areas lies in the development of this residential economy and in improving the supply and accessibility of both private and public services. The challenge here is twofold: on the one

hand, it is the condition of a demographic attractiveness of these areas and of improving the living conditions of people living there and, on the other hand, it is the base of economic development and growth in these areas. From this point of view, British policy for rural development is more explicitly concerned about this issue than French ones which are more focused on the agricultural sector alone.

4. An agricultural sector with low economic impact but still central in determining land use

The impact of agriculture on rural economies and its role as driving force of local economies are not limited to its low weight in the workforce. Taking into account its relationship with its upstream and downstream sectors located close to the concerned farms expands the sphere of influence of the agricultural sector. By examining several rural areas in Europe, including French and English ones, a Leontief or “input-output” modelling shows that, associated with its upstream and downstream sectors, the agri-food sphere (i.e. agriculture and local food industries taken separately or together) always has a certain capacity for driving local economies (Mayfield et al., 2005). The multipliers obtained are mainly between 1.1 and 2.5. However the driving effect of the agri-food industry is generally higher than that of the only agriculture and the comparison of multipliers obtained for the whole agricultural and agri-food sectors and those for other sectors shows that the former plays a higher role in economic development in the study areas. Thus, rural development is most likely to be driven by the development of agriculture as it is linked to a strong local agri-food industry. However, like all industries, the agri-food industry trends, albeit to a lesser extent, to cluster in urban areas. As much as the support of agriculture and farms, one of the challenges of rural development today could be to support a rural relocation of downstream industries of agriculture, and not just those relating to products known “de terroir”.

Finally, agriculture remains crucial in terms of land use: it covers 72% of British territory (in 2005) versus 54% of French territory (in 2009). The difference between both countries is mainly related to higher forest cover in France (24%) than in England (8.6%). The pressure on land use is high in both countries, especially near urban areas. The developed land affects 9% of French territory and over 10% of British territory; it is implemented for housing requirements but also for roads, commercial or logistic infrastructures or manufacturing or tourism facilities. This increased pressure on land use reinforces the increase in land prices but also causes problems in terms of fragmentation of land parcels and farms, environmental damages and conflicts of use or access to resources. Through its territorial coverage we point out the important role of agricultural activities with respect to environmental issues, resource management and production, which leads back to the debates on the Common Agricultural Policy (CAP) reform and its second pillar.

Some references

Buller H. (1991). Le processus de « counter-urbanisation » (Grande-Bretagne) et la « péri-urbanisation » (France) : deux modèles de retour à la campagne. *Economie Rurale*, 202-203 : 40-43.

Berry B. (1976). *Urbanisation and Counter urbanisation*. Berveley Hills: Sage.

National Institute for Farming and Food Investigation and Technology of Spain (INIA)

Champion A. (1994). Population Change and Migration in Britain since 1981: Evidence for Continuing Deconcentration. *Environment & Planning A*, 26(10): 1501-20.

Courtney P., Lépiciér D., Schmitt B., (2008) – Spatial Patterns of Production Linkages in the Context of Europe's Small Towns: How are Rural Firms Linked to the Local Economy? *Regional Studies*, 42(3): 355-374.

CRC (2010). *State of the countryside 2010*. London: CRC, 186 p.

Détang-Dessendré C., Goffette-Nagot F., Pigué V. (2008). Life-cycle Position and Migration to Urban and Rural Areas: Estimations of a Mixed Logit Model on French Data. *Journal of Regional Science*, 48(4): 789-824.

Hodge I., Midmore P. (2008). Models of Rural Development and Approaches to Analysis Evaluation and Decision- Making. *Economie Rurale*, 307: 23-38.

Hodge I., Monk S. (2004). The Economic Diversity of Rural England: Stylised Fallacies and Uncertain Evidence. *Journal of Rural Studies*, 20(3): 263-72.

INSEE, INRA (1998). *Les campagnes et leurs villes*. Paris : INSEE (Contours et Caractères), 78 p.

Laganier J., Vienne D. (2009). Recensement de la population de 2006 : la croissance retrouvée des espaces ruraux et des grandes villes. *INSEE Première*, 1218 : 1-6.

Le Bras H. (2007). *Les 4 mystères de la population française*. Paris : Odile Jacob, 304 p.

Léon Y. (2005). Rural Development in Europe: A Research Frontier for Agricultural Economists. *European Review of Agricultural Economics*, 32(3): 301-317.

Mayfield L., Courtney P., Tranter R., Jones P. Ford S., Agarwal S., McGeorge A., Schmitt B., Jobard M., Lepiciér D., Terluin I., van Leeuwen M., Heffner K., Rosner A., Czarnecki A., Diniz F. (2005). *The Role of Small and Medium-sized Towns in Rural Development*. Final Report, European Programme MARKETOWNS, 250 p.

Morel M.-P., Jean R. (2010). L'artificialisation atteint 9 % du territoire en 2009. *Agreste-Primeur*, 246 : 1-4.

Schmitt B. (2000). Economic Geography and Contemporary Rural Dynamics: An Empirical Test on Some French Regions. *Regional Studies*, 33: 697-711.

Schmitt B., Henry M.S., Pigué V., Hilal M. (2006). Urban Growth Effects on Rural Population, Export and Service Employment: Evidence from Eastern France. *The Annals of Regional Science*, 40(4): 779-801.

Terluin I.J., Post J.H. (Eds) (2000), *Employment Dynamics in Rural Europe*. Oxon: CABI Publishing.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Written evidence from Food Standards Agency (FSA) (IEUA 27)

Introduction

The Food Standards Agency

The FSA was established in April 2000 as a non-Ministerial UK Government Department, operating at arms' length from Ministers, headed by a Chair and Board, who are appointed to act in the public interest. The FSA is accountable to the Westminster Parliament, through health ministers, and similarly to the devolved administrations in Scotland, Wales and Northern Ireland. It has its own budget, which is negotiated directly with the Treasury.

The Food Standards Act 1999 states “the main objective of the Agency in carrying out its function is to protect public health from risks which may arise in connection with the consumption of food (including risks caused by the way in which it is produced and supplied) and otherwise to protect the interest of consumers in relation to food”. The Agency is responsible for assessing and managing risk in relation to food and communicating advice to the public. It is guided by a set of core principles: putting the consumer first; openness and independence; science and evidence-based.

Innovation in agriculture

Given the remit of the Food Standards Agency, this note does not attempt to address each of the 11 specific issues described in the Sub-Committee's Call for Evidence. However, the Agency's primary responsibilities – food safety and consumer interests – are highly relevant to innovation in agriculture and the following information may be useful to the Sub-Committee in its deliberations.

Innovation in agriculture is driven by a range of factors but the adoption of any new technology will ultimately depend on its success in the market, which is in many cases dependent on its acceptance by the end consumer. Consumers expect the food that they buy to be safe and nutritious, and it is a general requirement of food law that food business operators produce food that is safe and meets consumer expectations.

There are three areas, genetic modification, novel foods and animal feed, where innovations in agriculture are specifically regulated at EU level. The relevant regulations provide harmonised systems for ensuring that new foods and feed ingredients undergo a formal assessment for safety and nutritional quality before they can be placed on the market, as described below. While the need to gain authorisation could be seen as an obstacle to innovation – point 4 on the Committee's list of issues – it provides assurance to operators and end consumers that new products have been independently scrutinised before they are introduced to the market.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

In addition to complying with any regulatory requirements, those who would introduce new technologies also need to understand consumer attitudes and be prepared to address public concerns if their products are to be acceptable to the majority of final consumers. This is illustrated by an evidence review that was recently commissioned by this Agency into public attitudes to innovation in food production. This issue is not explicitly mentioned in the list that is included in the Committee's call for evidence, but it is nevertheless important for certain types of innovation.

The relevant EU regulations and the Agency's work on public attitudes are described below.

I. Genetically modified food and feed

The use of genetic modification offers new possibilities for plant breeders and the potential role of genetically modified (GM) crops has been discussed in a number of reports, including the Royal Society's 2009 review of sustainable intensification of global agriculture³³.

The use of GM crops in the EU is subject to the regulation on genetically modified food and feed, regulation (EC) 1829/2003. This regulation would also apply to GM animals, if these were to be developed and introduced in future.

Before a GM crop can be grown and used for food and/or animal feed, it must undergo a rigorous safety assessment, which is carried out by the European Food Safety Authority (EFSA). This assessment covers potential effects on human and animal health, and on the environment.

Regulation 1829/2003 also defines the requirements for labelling of GM food and feed so that consumers are informed of the use of GM materials and can exercise choice. There is an exemption for the presence of low levels (up to 0.9%) of GM material that is authorised and is present adventitiously, for example due to unavoidable mixing of consignments during transport or storage.

Member States hold a range of views on the use of genetic modification, with the result that authorisation decisions are routinely delayed because they do not attract the size of majority that is required under the EU rules. The GM food and feed regulation is currently being reviewed by the European Commission, which is due to publish a detailed evaluation report at the end of 2010. Depending on the outcome of this review the Commission may propose amendments to the regulations.

³³ Royal Society, October 2009

Reaping the benefits: Science and the sustainable intensification of global agriculture
<http://royalsociety.org/Content.aspx?id=4294967719>

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

The usual practice among food manufacturers and retailers in the UK and elsewhere in the EU is to avoid the use of GM ingredients, establishing and maintaining “identity preserved” supply chains that provide assurance that GM materials are not used, particularly for imported ingredients such as soya and maize derivatives. The demand for GM crops is therefore limited although farmers in some Member States (not including the UK) grow GM insect-resistant maize for animal feed purposes.

2. Novel foods

The European regulation on novel foods (Regulation (EC) 258/97) applies to foods and food ingredients that were not consumed in the EU prior to 15 May 1997. It establishes a mandatory pre-market approval system for all novel foods and novel processes and is legally binding across all twenty seven EU Member States. The regulation applies to manufactured ingredients such as synthetic sugars or fermentation products and also to agricultural products, including plants that are not indigenous to Europe and do not have a history of consumption in the EU.

The regulation could apply to innovation in EU agriculture in two ways: if a farmer wanted to produce a food crop that does not have a history of use in the EU, such as an exotic plant with potential nutritional benefits such as raised levels of omega-3 oils, or if a familiar plant or animal product is produced using a novel process that changes its properties. However, the scope of the novel foods regulation specifically excludes food from plants and animals produced by traditional breeding practices, where there is a history of consumption of the food, so it does not apply for example to new varieties that are produced by conventional plant breeding.

Other innovations, such as the use of laboratory techniques for the production of “meat” by tissue culture, could also have an impact on the agricultural industry. This kind of product would also require a full safety assessment and authorisation as a novel food before it could be marketed.

The person wishing to market a novel food must make an application to one of the Member States, who will carry out an initial assessment against three criteria of safety, nutritional quality and consumer information. The initial assessment report is distributed to the other member states and a decision on authorisation is reached either by consensus or, more often, by a formal majority vote. The European Food Safety Authority is consulted if there are disagreements between the Member States’ authorities on scientific issues.

In January 2008 the European Commission published a proposal to revise and update the 1997 regulation. This proposal is still under discussion by Member States and the European Parliament and, if adopted, will clarify the scope of the regulation and streamline the procedures for applications and authorisations.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

3. Animal Feed

EU legislation on animal feed covers the additives (vitamins, colourants, flavourings, binders, and so on) that are authorised for use in animal feed; the maximum levels of various contaminants (e.g. arsenic, lead, dioxins); ingredients that may not be used in feed; nutritional claims that can be made for certain feeds; the names and descriptions which must be applied to various feed materials; and the information to be provided on feed labels.

Certain types of innovation in animal feed production would require a pre-market approval, such as the use of new additives or the manufacture of bioproteins by new methods. Evaluations of new products are carried out by the Animal Feed Panel of the European Food Safety Authority and each authorisation is subject to a vote among the Member States

4. Public attitudes to innovation

In September 2008 the Food Standards Agency commissioned a review of existing studies on public attitudes to a range of emerging food technologies, including genetic modification and animal cloning. This report was published in March 2009³⁴ and a copy is attached for the Committee's information.

The main findings were that public attitudes are largely unsupportive of new technologies in food production, although there is a large middle ground of individuals who do not have fixed views. The level of knowledge of new technologies is generally low, but the evidence on the relationship between “opinion” and “knowledge” is ambiguous. Key factors in determining an individual's views are perceptions of benefit and risk, and ethical or moral factors. The latter are particularly relevant for the agricultural technologies that were examined (GM and animal cloning).

The review noted that people's stated purchasing intentions are strongly linked to their attitudes, but there is a weaker link between either of these and their actual choices in the “real world”.

In addition, the Agency has commissioned work to examine attitudes to GM food. This was done as part of the 2008 British Social Attitudes Survey and include in depth interviews with individuals holding a range of views on GM foods, coupled with workshops to explore the factors that shape attitudes to GM and the impact of information³⁵.

4 October 2010

³⁴ Food Standards Agency, March 2009. Public attitudes to emerging food technologies. A report carried out by Brooke Lyndhurst on behalf of the Social Science Research Unit, Food Standards Agency.

<http://www.food.gov.uk/news/newsarchive/2009/mar/tech>

³⁵ Food Standards Agency, November 2009. Exploring attitudes to GM food. A report prepared by the National Centre for Social Research for the Social Science Research Unit, Food Standards Agency.

<http://www.food.gov.uk/news/newsarchive/2009/nov/gmreport>

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Written evidence from Wm Morrison Supermarkets plc (IEUA 31)

About Morrisons

- Morrisons' is the UK's fourth largest supermarket with 432 stores across the country, supported by a workforce of more than 130,000. Every week in excess of 11 million customers pass through our doors.
- Morrisons' business model is different from many other supermarket retailers. We source most of our meat and produce direct from farms and prepare and process it ourselves. This supply chain gives us an unrivalled opportunity to provide customers with fresh quality food at affordable prices. As we are closer to source, it also gives us first-hand understanding of the issues faced by farmers in the supply chain.
- Morrisons' vision for the future of British farming is a highly productive and efficient supply chain developed within a framework that ensures good science-based ethical and environmental standards delivering competitive products that are affordable.

Introduction

- 1.1 Morrisons welcomes the opportunity, as a retailer and food manufacturer, to respond to the House of Lords EU Agriculture, Fisheries and Environment Sub-Committee Inquiry "*Innovation in EU Agriculture*".
- 1.2 The response summarises some of Morrisons' practices to boost innovation in British agriculture and improve the economic and environmental sustainability of the sector.

Response

- 2.1 Morrisons would define innovation in agriculture as the development of new technologies and methods to drive affordability for the consumer, profitability for the farmer and protection of the environment. We believe innovation (and the research and development needed to produce it) is crucial to the long-term viability of the farming industry, with its potential to increase productivity, reduce costs and minimise environmental impact.
- 2.2 Harnessing the potential of innovation assumes added importance as CAP reform promises to restrict public support for agriculture and farmers are being asked to produce more from less. The key to achieving this, at a time of increasing price pressures, must be a combination of investment and partnership across the entire sector.
- 2.3 Given their size, most farm businesses do not have the capacity to invest in research, which represents an obstacle to innovation. While the Government spends significant sums on food-related research, the pressure on the public finances suggests that this may be constrained in future. There is a role for food businesses to support innovation in agriculture and encourage its application among primary producers, particularly in the absence of a public extension service.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

2.4 Morrisons is funding a broad range of research projects across the agricultural spectrum. In 2009 we launched The Morrisons Farming Programme, to enable us to play an expanded role in building a sustainable British farming industry. To ensure that our research meets the needs of the industry, the ideas for projects are farmer-led and backed by industry bodies and research institutes.

2.5 Our research priorities also reflect the needs of our 11 million customers, who want great value but also care about the environment, animal welfare and where their food comes from. Morrisons has responded to their wishes by sourcing 100% British fresh meat and is alone among major retailers in doing so. Our ability to maintain this policy is dependent on a viable British farming industry, which our Farming Programme is helping to secure.

2.6 A number of projects have been completed and are delivering real benefits for the wider farming community. Examples include:

- The UK's first independent report on renewable energy options
- An examination of the potential for cross breeding to improve efficiency in the dairy sector
- Encouraging free-range hens to better use the range available
- Tackling wet litter issues in the poultry sector

2.6 Morrisons is committed to helping as many farmers as possible to innovate and so we do not restrict our research findings to dedicated groups of suppliers. Taking one example, our involvement in research on renewable energy technology offers benefits to the whole of the dairy sector, not just a limited group of farmers. It was prompted by dairy farmers, who told us they wanted an independent investigation of where they could make energy efficiencies in a typical dairy business, and what options were available to do this.

2.7 This led to Morrisons commissioning Newcastle University to produce a report on the relative attractiveness of different renewable energy options, including anaerobic digestion, biomass, solar and wind. The report indicates that adoption of energy-efficiency technology has the potential to help dairy farmers cut costs by as much as 30%, representing a yearly saving of over £3,000 on a typical dairy farm.

2.8 We know that commissioning projects is only one part of the solution. For our research to really make a difference it must be effectively communicated to the widest possible audience. Our direct involvement in every part of the supply chain means we are uniquely placed to do this.

2.9 Morrisons is actively facilitating knowledge transfer. We are focussed on translating our research into real on-farm benefits through the development of a demonstration farm, where we will apply our research for practical use and showcase the potential benefits, and with the creation of a network of farmer groups.

2.10 Our farmer groups span the agricultural spectrum, from beef to dairy to poultry to grain. The groups bring together farmer, processor and retailer with a common goal of

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

working in partnership to develop methods which can boost farmers' profits and protect the natural environment. The groups also act as a platform for ideas for farming research projects that can be funded by the Morrisons Farming Programme.

- 2.11 A cornerstone of our Farming Programme is the 1,000 acre Morrisons Farm at The Dumfries House Estate in Ayrshire, Scotland. This is a working farm we acquired in 2009 in partnership with The Duke of Rothesay, which will become home to our applied research into sustainable farming. We envisage Morrisons Farm as a centre for farming excellence, promoting a sustainable British farming industry which continues to supply quality and affordable fresh food for consumers.
- 2.12 As part of our multi-million pound investment we will examine existing and new farming techniques to see how efficient and profitable production systems can be combined with high welfare and environmental standards to produce excellent food products. As a start, we are looking at how the productivity of our beef herds can be improved while reducing the use of fertilisers and other inputs.
- 2.13 In time it will also provide a valuable function as a demonstration farm, where farmers can see for themselves the potential benefits of our research and share their own experiences.

5 November 2010

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Oral evidence, 16 February 2011, Q 437-476

Evidence Session No. 12. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Caithness
Baroness Howarth of Breckland
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witness

Professor Peter Lillford, [Visiting Professor, Department of Biology, University of York].

Q418 The Chairman: Professor Lillford, you are very welcome today. We are very pleased that you are able to come and speak to us, given your distinguished career in this area. Thank you. I shall deal with some of the formalities first. You have in front of you a list of interests that have been declared by Committee Members. This is a formal evidence-taking session of the Sub-Committee. A full transcript is being taken. This will go on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise it for minor errors. The session is on the record. It is being webcast and it will be subsequently available on the parliamentary website. I wonder if you could start, for the record, by stating your name, and then we can go from there.

Professor Peter Lillford: My name is Peter Lillford.

Q419 The Chairman: Thank you. You have been involved for many years in issues related to food production, in particular your chairmanship of the RSC IChemE working party that published the January 2009 report, *The Vital Ingredient*. How do you see the relationship between food and agricultural innovation? Secondly, what is the relationship between consumers, retailers and processors in determining the trends in food?

Professor Peter Lillford: It is a complex question and I will try to answer it as directly as I can. The food industry primarily sees agriculture as the provider of primary produce, or raw materials. Any advance in, for example, yield is of benefit to the rest of the chain, but largely because we think it will keep prices down. Other innovations that improve crop quality in terms of its minimal processing or, these days, health benefit is of course of major interest to us. There is a very definite interaction between what happens on the farm and outside the farm gate, but our attitudes to it can be quite different, in terms of what it provides us.

Secondly, you asked about the relationship between consumers, retailers and processors. This used to be very simple indeed. Essentially, throughout the food chain from inside the

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

farm gate right to the retailer's shop, we all thought we understood what we were supposed to be doing. We first of all provided safety. That is mandatory and we all know that we go to prison if we break those laws. More importantly, we thought that we should provide convenience, something nice to eat—which we call quality—and, of course, at the most reasonable cost or best value for money. That really drove all of us simultaneously for many years.

Down the food chain we compete extensively. Margins are quite small in our industry, but volumes are massive. So the name of the game, between all the players from the farmer, through the ingredient supplier to the manufacturer and retailer, is to steal each other's margins. We do this by innovative competition. As I said, we all thought until recently that we knew the rules of the game: it was simply to provide something that people would buy, because it was nice to eat, at the right price and safe.

That has changed quite dramatically. That is why I am so pleased to be here this morning. Now we have what we call the alerted consumer. The consumer has been awakened by new technology to look very carefully again at what safety is and how it is provided, what variety is, why costs are structured in that way and what we do to the stuff that they buy—where does it come from? So, things like traceability and authenticity are raising their head, which we must recognise. Health is a massive issue now, which the entire chain recognises. We are somewhat upset about being accused of making everybody fat. We thought we were just giving them nice things to eat. But we recognise that it is down to us to redesign products for health. This represents enormous technological challenges for us.

Equally well, sustainability, in which I include climate change effects, is now a recognised major issue. Most members of the chain recognise its importance. The consumer, however, does not. There are activists who do, but the average consumer says, "I'm sure there's a problem, and it's yours, so I'll have that, please, but at the same cost."

So we face this issue, but here we have trouble with the consumer, because they never cease making demands on what we provide to them and they prefer that it should have no added cost. These days, the innovation chain is becoming much more diffuse and much more selective, and with new, major challenges. It is some of those that I would like to tease apart with you today, because it is vital to understand how the players will behave in the future. I understand that your Lordships are primarily concerned with agriculture, but agriculture is a global business and so is manufacture. There are a handful of very large companies that now dominate innovation and market share. They have the turnover of a small nation state and a global reach bigger than the British Empire. Those are going to be quite different in the way they respond to new challenges and innovation compared with another manufacturer who perhaps makes your croissant in the morning and considers it an innovation to add some chocolate topping.

There is an enormous range of issues, even when you use the word "innovation". The players in the chain do not necessarily mean the same thing. This is what we tried to draw out in *The Vital Ingredient* report. It is vital, because to take the nice statistics that we all present saying that we are the biggest manufacturing industry in Britain, and so on, hides a multitude of variation that needs to be considered when you look at future scenarios and innovation. There is a lot more I could say.

The Chairman: You have raised the question of multinational food companies. Perhaps Baroness Sharp could go into that.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Q420 Baroness Sharp of Guildford: Can we take you up on what you have said about a small number of companies dominating turnover here? What impact do you think the big multinational food companies have on innovation in the context of the global food system? Do you think that the detailed specifications that they apply to primary producers inhibit innovation, or does that add to innovation? How do you see that developing?

Professor Peter Lillford: This is the question I wanted you to ask, because it is crucial. The attitude of the large companies is that they are global. They are in favour of innovation in those things that they wish to dominate globally. The thing about big manufacturers is that they are very segmented. Most of them will not be in the least bit interested in innovation outside their brand space, as we call it. For example, I used to work for Unilever. If you do anything new in tea or ice cream, we want it. If you do something in vegetables, that is somebody else's business. They are vitally interested in innovation, but only in the space that they wish to occupy.

The other thing about the big companies is that they are very powerful. I was honoured to work for Unilever for a long time. I had a research department larger than most universities' in the UK, and of a similar standard. We can make breakthroughs in big companies. I will give you an example. We were very proud when we produced a margarine that lowered your cholesterol. This was a major breakthrough and it cost millions in R&D support. Small companies can never do that.

However, can there be coexistence between large and small? I really believe there can. There is a vulnerability in being global. You cannot do anything small. You cannot cope with it. If somebody produces an innovation that affects your business and you did not control it, you scurry and you work very hard. There is a role for small companies, farming included. There is also a growing need for shrunken regionalised food chains. The Royal Society produced a very good report on sustainability. In one chapter there is an interesting quote about regional sustainable food chains. When you look into this, it is almost going back to where we used to be, when produce was made, converted and manufactured locally and was distributed locally. Why can't we go back to that? Some of the trends that relate to energy production and waste reduction will drive us in that direction and the big companies will not be interested in going there.

Baroness Sharp of Guildford: When we had foot and mouth disease, for example, we were amazed to discover the extent to which sheep were being transferred from one end of the country to another and then back again.

Professor Peter Lillford: Many of the reports, including the RSC report, highlight some of these issues. A document produced by the Cabinet Office ("Food Matters") contains much of the same material as our report, because we made a major input to it. In some cases, it is better written than ours. It makes this point that the world is going to change because the paradigm at the moment is cheap energy and easy distribution. That is not going to go away. Why are local chains not building more rapidly? The problem is capital and vision. They will happen. That is where real entrepreneurship will take place within the United Kingdom, if we support it. This is a vital issue and I think that there are conflicts in many cases between big and small in the food chain providers. We need to recognise them, but they can coexist.

Q421 Baroness Sharp of Guildford: Can I raise a somewhat different issue in relation to multinationals, which is the use of biotechnology in the food chain? How likely do you think they are to advocate its use by suppliers to ensure that specifications are fulfilled?

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Professor Peter Lillford: That depends on where you are. For example, with the global companies, we have no trouble in specifying and accepting it in countries where the consumer accepts it. You find a discontinuity in attitude between what happens in America and what happens in Europe.

To be honest, the manufacturers and retailers are quite comfortable with this. We will not risk consumer resistance. We will try to persuade, but the big issue that arose over the GM debate in this country—and it started here—was the belief of the public that they were being forced into something that they neither understood, trusted nor needed. We have to respect that, and by and large we do.

Unilever was part of the exercise that put the first GM product on supermarket shelves in the UK. We spent a lot of time educating the consumer and giving them a benefit. They bought it without any complaint. But then it was announced that, of course, all soya beans, all wheat, all rape seed and so on would be globalised with GM. The public uproar was amazing. The manufacturers and retailers, aware of their dependence on public support, pulled out. They will not go back in, in Europe at any rate, unless we persuade the consumer that it is in their interests. We believe in many cases that it is. One of my jobs as a professor of public awareness of science is to give lectures on this topic. One of the things I enjoyed most in the GM debate was talking to the WI. These people asked very sensible questions and were very open in their attitudes. I lost my case, but at least they understood what it was all about. This is absolutely necessary in the future and should continue.

Q422 Baroness Howarth of Breckland: We have moved into my area, which is about consumer attitudes. Although it is not a relevant declaration for this morning, for seven years, from 2000, I was on the board of the Food Standards Agency. I say that because that is when there were some exciting debates about GM and a lot of discussion about how we were going to try to change attitudes among consumers, which we failed to do. Between now and then, there appears to have been some movement in consumer attitudes. How far do you think that has come generally in terms of the way the consumer looks at these issues—not GM, but other issues—and how do you think that the scientific community can provide leadership in helping that understanding, and who else should be doing it in partnership?

Professor Peter Lillford: The consumer initially, to my mind quite rightly, was concerned and confused by the advice they were given about this technology. While those who benefited from it advocated it very strongly, environmentalists—who are also specialists—said, “Well hang on a minute; we are not so sure”. Our consumers, or at least the alerted and aware ones, hear these arguments and say, “Well, if you experts can’t agree then just wait a second, please”.

Some of the greater fears now seem to have diminished. As yet, there has been no major environmental catastrophe. People have not grown two heads from eating soya beans, and so on. So the consumer is now watching progress and saying, “Well, it is not as frightening as we thought it might be and there are cases for it”. If we can put genuinely well argued scientific cases for GM in the face of rising commodity food prices, which the consumer understands because it puts up the cost in the shop, and we can link it to sound science, I believe they will listen.

In all the GM debates that I took in the first round, people were very interested. Food is very personal. All they were saying at that time was, “We don’t know enough”. In many cases, they did not say, “No, absolutely”; they said, “Not yet”. As evidence develops, I believe that the alerted consumers, who are highly intelligent, can take part in this debate.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Who should take part? Well, I do—people who have some experience of the science and the technology and its application in terms of what it means to the supply chain. That needs to be demonstrated. We need the private sector to come out and talk sensibly and demonstrate that, while they have a vested interest, that is not what we are talking about today.

The GM debate was one of the most enjoyable parts of my life. We need to have this continuously and if we were to formally start it again, that would be admirable, because you would find that the public are still just as engaged with food as they ever were, but they are more prepared now to look at the evidence and to be less afraid of what they see coming up.

Q423 Baroness Howarth of Breckland: We have heard from some witnesses that they think the Government have a part in this, too. Do you think that is so?

Professor Peter Lillford: Absolutely, I do. As far as most consumers recognise, they assume that the Government looks after their welfare. It uses public money to develop R&D and to support agencies such as the FSA to keep them safe. Of course the Government has a part in it. It is those players that the Government should support who should be in the public domain explaining what they do and how they do it.

Q424 Baroness Howarth of Breckland: From your in-depth and wide experience, how do you think you should actively involve the public in understanding some of this biotechnology? Linked to that, because I am interested, if the public understood yield issues in relation to some of these questions—we have heard of startlingly different yields from America, Brazil and Europe—do you think that would have an effect on attitudes?

Professor Peter Lillford: Yes, there is a sector of the consumer audience that I have called alerted. These people are anxious to debate. I used a technique in the first round where I explained some of the technology and then used the audience as representatives of players in the food chain: you are a farmers' group, I give you this technology, what do you think of it? Within an audience of untrained people, you can get them to recognise the significance of this technology in an hour. I remember one lady who was the retailer who said, "I don't care what you say, professor love, it's not coming in my shop". These are the attitudes that occur in real life. When people have been through one of these discussions and debates, they come out saying, "I get it now. It is complex. Different sectors have a different influence. Of course there are vested interests. Now I understand what you mean". We can do this. I really believe that the consumer is looking to the Government to lead this kind of public education. Heaven knows, we have enough bright people in this country who are willing to do it and it should be encouraged.

Q425 Baroness Parminter: Is that model applicable to the other area of consumer debate that we have not yet touched on, which is the issue of climate change? You said that the public are not on side, because there will be issues around less meat and not having pineapples in July. If we look at the figures, by 2050 agriculture is going to be contributing more in emissions than other sectors, which will have innovated in the mean time. Unless we get the consumers on side, retailers will not act and we will not get innovation. Is the model that you talk about of the Government leading a debate on climate change the only way that one can resolve that problem?

Professor Peter Lillford: First of all, I would like to debate one of the things you have said: if the consumer is not on board it will not happen. I think it will. It is very important to the

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

farmer and the manufacturer, in terms of the technologies they are going to have to use. If I am working for a global company, how I am going to source things is important.

I agree with you that if the consumer is concerned about sustainability, and there are approximately 10% of consumers in the UK who are—these figures come from Marks & Spencer, so they must be true—they will lead the charge. We need to work with the consumers who are alerted and the rest will begin to pick up the issue and follow it.

The thing about GM was that it was something that everybody put in their mouth now. Sustainability is not like that. It is about a problem of sourcing and supplying, management and control. By and large the consumer says, “That’s your problem. I’m all in favour of it as long as it doesn’t cost me anything”. The way to engage the public is different. We need to say again, “These are the issues that the people who make and provide your food are going to face. They can’t avoid it. What this means to you is that the following will happen. Are you happy?” Then they think about it and have a position on which they can make a judgment for or against, in support or in denial. At the moment it means very little to most consumers. We engage them by giving them a vision of what their food supply chain could be like because of climate change underneath the sustainability. They just do not get it. It is still in Tesco, so what is the problem? If we say that it will not be in Tesco and it will be made from something else, and that wheat will not come from where you think it comes from, they will ask why. Now you have engagement. But at the moment it is too diffuse and distant a topic for people other than the passionate to engage with. “Fair Trade coffee is quite nice, but is it the same price and does it taste any better? If not, I am not interested.” That is the average response at the moment.

Q426 Baroness Parminter: Can I take you on to the issue of investment and paying for technological advances? In your report, you talked about the balance between private and public. Can you expand a bit on the right balance between public and private sector investment in science and technology?

Professor Peter Lillford: Again, I have to answer this almost twice, because it relates to the issue of scale that I raised earlier. The big companies are eminently capable of looking after themselves. They will hate me saying that, but it is probably true. However, the food chain, and agriculture particularly, is fixed by geography. Supporting innovation geographically depends on the nature of the agriculture and farming that can reasonably occur there. The global people source globally, as long as they can get it. Their issues are global and the R&D that they relate to is about global trends and big science, implemented anywhere in the world. If we are talking about agriculture on a regional or national basis, we are not talking about that; we are talking about what you can grow, develop and sell in East Anglia or the North Riding of Yorkshire. That requires a different kind of innovation or interaction with what I am calling the national or regional sustainability chain.

The trouble is that the little guys have difficulty in understanding the technology or generating a communal voice on what they need and why. We have to look quite consciously at public investment and analyse who it is for and where it will go. If you develop a double yield in wheat, where will this go? It will go to East Anglia, but it will not change world commodity prices. We can influence the globe with innovations like that, but if we want to help a farmer who is looking at his horticultural crop, we need to develop a localised supply chain where he has the technology to convert this into a higher value product. Why can’t he make yoghurt? The answer is because he is a farmer and he does not know how. There are people who can teach him. In our report we put a major issue on downscaling manufacturing processes, because we believe we can now take what used to be

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

economy-of-scale big processes and turn them into highly automated smaller ones. This would create innovation for this regional and national new food chain that we probably have to create.

When we look at our investment in public sector R&D, we have to think about where it will go. We can build a scenario of where it will go and then we can make better judgments of how much we should spend on it. In terms of overall amounts, the more the better, please. I would say that, wouldn't I? The taxpayer is dedicated to their food supply and we believe there are enormous opportunities.

Following the report, we commissioned a workshop. The report says that things should be done. We called together retailers, manufacturers, government parties and consumers and said, "Okay, but what should we do in the UK?" That workshop is also going to be reported by the Institute of Chemical Engineering. It says that we need to look at this regionalisation and localisation of new, revived supply chains as well as the big games that we have always been playing. I am not quite sure how we do that.

Q427 Baroness Parminter: Can I ask a supplementary to that? How do we ensure that the private sector, with the limited investment that they have, do not just go into products that are going to make them money, but are about delivering sustainably produced products that are nutritious? You gave the example of the cholesterol product. It had nothing to do with the health issue; it was just that the company knew that more people would want it, therefore it would make more money. Is it possible to move the levers of funding in private sector companies so that some of it goes towards sustainable production of nutritious food?

Professor Peter Lillford: Yes, I believe it is. First of all, the smaller companies are essentially frightened. They see big changes coming and they do not know how to cope. If we put them into a forum with each other and with the larger manufacturers who are global drivers, the dialogue takes place and people begin to understand what it is about. We do not have enough mechanisms for public-private partnerships in R&D in the food chain in the UK. For the moment, I chair the last of the Defra Links schemes. BBSRC attempts to do the same. My belief is that these are rather feeble attempts to do what you think should be done. I have run Links schemes where big companies have sat alongside smaller companies and manufacturers. They do not see them as competitors. They are playing in a different space. The information gets transferred. "How do you make that thing, anyway? Why did you do it?" This is the information transfer that can take place if you build consortia of interested people looking at innovation. We have nowhere near enough of that in the UK. I warn your Lordships that other states in Europe do. There is the great Wageningen valley of innovation. It has been built by a combination of Unilever and the Dutch Government, and various other parties. It is now a hub for innovation in Europe. The French, of course, are determined to build continuity of innovation from agriculture into food in their nation state, and they do it via their national resources. We seem to think that food will always be there and it will just turn up somewhere. I really believe that we have to take this issue much more conscientiously. I believe that we have some mechanisms to do it; I just regret that they seem to be somewhat on the wane at the moment.

Q428 The Chairman: Why do you think that is? Why have The Netherlands and other countries done better?

Professor Peter Lillford: It is called a national plan, actually. They are a smaller nation than us with less global ambition, but they have decided that they are going to be very good at

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

food and food processing in Europe. I gather that we have decided we are going to be the bankers of Europe, so it is a less high priority for us.

The Chairman: I think we should move to the next question. Perhaps we might return to that.

Professor Peter Lillford: It is because the food industry does not represent such a high priority in our nation as it probably should. I will leave it there.

Q429 The Earl of Caithness: Is that last comment UK-wide or England?

Professor Peter Lillford: Ah, that is a good question, isn't it? The Scottish have what I believe is a more favourable attitude than us.

Q430 The Earl of Caithness: We will leave it there. One-nil to Scotland.

Professor, you state in your report, *The Vital Ingredient*, “chemical science and engineering will provide sustainable ways to match increasing demands for food with limited natural resources.” That is quite a statement. Can you justify it? What are going to be the triggers?

Professor Peter Lillford: Yes, I believe I can. Part of the reason for the Royal Society of Chemistry and IChemE producing this report was that we felt that there was a lot of attention being paid to the innovations in biological sciences, which are of course massive, but we felt that there was more to innovation than –omics. If you look at the way scientific discovery is transferred into technology, and therefore commercial viability, a lot of the skills necessary to do that are the classical skills of chemistry and engineering. Give a biologist a pile of plants to make a food product and I would run for cover. In the process of turning a discovery into a product and innovation, the skills of engineering in upscaling, quality control, manufacturing, systems analysis and so on are still as vital as they ever were. This is where we feel that we need to put our stake in the ground and say, in terms of the chemistry of stability of food and its preservation and safety, in terms of the upscaling of large-scale factories or even small-scale devices for quality control, these are the skills of engineering and chemistry. In the report, we put whole examples throughout the food chain of where we felt that these more traditional sciences, which do not get quite the limelight that molecular and cell biology do, are important. We are not looking to deny the driving science innovation of biology. We are saying that if you want to turn it into products and money, you will have to consider the older disciplines and use them properly. Equally well, we have to train engineers to understand a bit more about cells and biology and less about stainless steel. It works both ways.

Q431 The Earl of Caithness: If we accept that, how do you then transfer that technology into the marketplace?

Professor Peter Lillford: Right. Unfortunately, in devices and manufacturing, you probably go and talk to a foreign company that manufactures equipment, machines, measurement control devices and so on. Then you bring it back in. This is an unfortunate consequence of the decline of our traditional manufacturing and chemical engineering industries. However, going back to downscaling, I believe that in the future we could use these skills to build new processes in a different style and behaviour for the UK at a small-scale level. We were brave enough to call the workshop “A second industrial revolution”. I think that is what is necessary. We have built our food society on the chemical engineering grounds of economy of scale. That is based around cheap energy and cheap fuel. It does not work any more, or it will not. The same skills could use those developments and build new industry in the UK if we are brave enough to do so. What I am afraid of is that those innovations will be left to

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

other countries more capable of implementing the technology. That is what I would like to bring to your Lordships' attention. We are missing a trick in the UK—or we will if we are not careful.

Q432 The Earl of Caithness: How do we close that trick?

Professor Peter Lillford: If I knew that I would be a millionaire. There are sufficient people in the UK with ideas and with needs to build their smaller businesses into something more modern and more innovative. You look for innovators who are anxious to develop and grow from small businesses. You look for people who are naturally inventive. We have them. We have to go out and search for them. Then we have to give them some help. This is the other thing. It is very difficult to start a new business. Venture capitalists want a guaranteed return. That is where I think Governments can assist. I know that European rules say that state aid and direct support is not allowed, but the encouragement of technology transfer via innovation can be stimulated by Governments by these sorts of forums. The bright guys will do it for you if you give them half a chance.

Q433 The Earl of Caithness: You use the words “you” and “we” on technology innovation. Let's get that clear. Who are you saying is “you” and who are “we”?

Professor Peter Lillford: I am saying that I am part of the food chain and part of its R&D, which is capable of producing ideas that people will build into new businesses if we help them. “You”, I assume, are the Government—in other words, those people who hold the responsibility for planning the public future. As a taxpayer, I expect my Parliament and its Members to defend and support the future of my nation state. So you, as far as I am concerned, in part, represent my nation state. It has entrepreneurs and it needs your support to recognise and assist them. That is what I mean.

Q434 Baroness Howarth of Breckland: I was interested in what you were saying about how you help innovation at farm level. If you are encouraging research in biology at the lab, on the desk, you get a grant where you can take a risk, and the risk might fail. You are involved in looking ahead in a futuristic way. We do not do that when it comes to the transfer. Are you saying that if we were able to take risks at production level, as we do at the lab level, we would move this forward much faster?

Professor Peter Lillford: Absolutely right. There are ways of doing this and minimising the risk. The DTI had a scheme called demonstrator projects, where a company willing to take a risk is supported by the state provided that it demonstrates its learnings to its business peers. This is a good mechanism, I believe, because you take the risk once and the whole nation sees the benefit of it. It is not then a question of every entrepreneur having to take the risk himself, or Governments having to dish out cash to anybody with a good idea, which is equally impossible. This idea of technology transfer via demonstrator projects is the way to do it.

Q435 The Chairman: I have one final, brief question. You have covered most of this, but how can “you”—the Government—at national level and at European level do something about this? We hear these visionary statements about innovation and Europe 2020. Our own Ministers talk about visions and so on. How do we get from the vision to some concrete actions that are going to move the dial?

Professor Peter Lillford: There is a thing called the European Technology Platform for food, which I have some involvement with. It attempts to bring forward concepts to the EU, which will involve the nation states. One of those has been the idea of public-private partnerships. I

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

am on that sub-committee. I am ashamed to say that, whereas my colleagues from Finland, Holland and France were able to point to existing programmes of public-private partnerships to do just this, I could not. This is really very sad and is one of the reasons I am delighted to be here. I am going to try to establish these, because I believe my nation needs it. That is the way I think we do it.

The Chairman: That is an excellent note to end on, and we are very grateful for the points you have made, Professor. It has been tremendous. Thank you.

Examination of Witnesses

Tim Smith, [Chief Executive, Food Standards Agency], **David Evans**, [Head of Agriculture, Morrisons], **Martyn Jones**, [Corporate Services Director, Morrisons], and **Sue Davies**, [Chief Policy Adviser, Which?].

Q436 The Chairman: Mr Smith, Ms Davies, Mr Jones and Mr Evans, welcome. We are very grateful that you have come today to give us evidence. On a small housekeeping matter, you may hear a loud bell ringing at some point in the next 45 minutes. That will be a division being called in the Lords, and we will have to break at that point and go to vote. We apologise in advance if that happens.

These are the formal points. I think you have in front of you a list of interests that have been declared by Committee Members. This is a formal evidence-taking session of the Sub-Committee. A full transcript will be taken and that will go on the public record. It will be printed and put on the parliamentary website. We will send you a copy, which you will be able to revise for minor errors. The session is being recorded. It is on the record and on the parliamentary website and you will be able to see that.

I wonder whether each of you could, just for the record, state your names and organisations and then we will go to the individual questions, if we may.

Tim Smith: Good morning. My name is Tim Smith and I am the chief executive of the Food Standards Agency.

Sue Davies: Hello, I am Sue Davies and I am chief policy adviser at Which?, the consumer organisation.

Martyn Jones: Good morning. I am Martyn Jones and I am the group corporate services director of Morrisons supermarket.

David Evans: Good morning. My name is David Evans. I am head of agricultural affairs for Morrisons supermarket.

Q437 The Chairman: Thank you very much. I think you know how we intend to do this. We are going to ask a specific question to each of you and then some more general questions. I will begin with a question for Mr Evans and Mr Jones. In your written evidence, you say that the key to achieving the potential of innovation in agriculture must be “a combination of investment and partnership across the entire sector”, which we very much

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

agree with. First, we would like you to comment on how this can be achieved and what you do to facilitate the sharing of knowledge and ideas across the sector. Secondly, how do you and your partners decide the priorities? You say that your policies reflect the needs of your 11 million customers, but how do you find out what they are and how do you establish priorities in those? Overlaid on that is the question of public policy priorities, diet, global warming, food security and so on. If you could start with those, we would be very grateful.

Martyn Jones: From an overall perspective, we have 11 million customers every week coming through our doors and we are a major buyer of British produce and meat. Part of our difference is that we are committed to buying 100% British fresh meat as part of our offer. For us it is important that we run a programme with our producers. Again, one point of difference from our competition is that we are vertically integrated, so we have our own abattoirs and produce pack houses and we buy direct from farmers and farmer producer groups. It is important that we understand the needs of our consumers and of our supply base. We work very closely on that. David runs the programme for me to find out from our producers and our farmer groups what their priorities and pressures are, in terms of cost, sustainability and quality. My primary purpose is to ensure that our consumers are getting the best quality that we can supply affordably—affordability remains key to them—but that also provides the producers with a profitable and sustainable method of supply. The programme that we have put together is designed to tick as many of those boxes as we can, in conjunction with that producer group, which David manages on our behalf.

David Evans: To add to that, we are major buyers of British produce and we operate in just about every farming sector. We need to take a whole supply chain approach, not deal with it in isolation. We develop supply chain management groups or producer groups within every sector. As a group—this is where the partnership comes in—we then sit down together and discuss opportunities that we can take forward or barriers that we see prohibiting us from going forward. Clearly, we then prioritise those between fields to give us the best impact now or in the future. That is where the investment part comes in. We as a company invest many millions in this programme and say that we will specifically look at a given issue to try to resolve it so that we can make ourselves more competitive.

That is working with our producer groups on direct investment and making them more competitive. Having worked across agriculture in many countries, we understand that innovation in agriculture is very difficult at farm level, simply because farmers do not have the level of profit to take the risk on innovation. We have our own farm, Morrisons farm at Dumfries House, where we try to take a leading role. When our producers say that there is something they really want to look at and the evidence and the research is out there for us to apply, someone has to take the risk. So we try to help by doing that on our farm. We take it on and try to implement the applied research. If it is successful and if we can apply it profitably and sustainably, that is extended to the farmers. That is basically how we would do it.

Q438 The Chairman: Have you proved to your own satisfaction that more capital inputs into your own farm and the ability to have a balance sheet that lets you take risk has given you a positive return?

David Evans: At a farm level, that is where the biggest issue is. Because we are dealing with medium-sized, or usually small, businesses, the farmer never has the capital to take the initial risk on investment. That is where the problem is.

Martyn Jones: At this point in time, we take this as an investment opportunity to prove that point. Therefore, we are creating a demonstration farm. We are on a three-year programme

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

with that. We started last year and at the moment we are putting money into that farm to develop a programme specifically around beef, to produce beef of the right quality, with the right input costs and as sustainably as we can. That is the programme that we are developing over the next three years. When we have proven that programme, we are going to share it with our big producer groups, to say, “Here is a programme that has worked for us as a live case study. Would you be willing to try that programme on your farm?”

Q439 Baroness Sharp of Guildford: Are you actively putting capital into your supply chain partners?

Martyn Jones: We are investing money to facilitate projects and programmes and research, as we said in our paper, for example, on renewable energy. We put cash into a programme of research with Newcastle University to share with our dairy farmers ways of reducing the cost of production through renewable energy and improved energy costs. That is a win-win project, as we see it. We act as the catalyst for that particular supply group. David manages that programme, which came from talking to that farmer group and asking what the areas of concern and interest were to them in reducing their production. Energy was clearly part of that. As a consequence of that work on a dairy farm, the research has been able to demonstrate a potential saving of up to £3,000 a year on a typical dairy farm in energy cost reductions. That is a practical way for us to invest in research that we can share with our producer groups to make the cost of production for them more profitable and, at the same time, deliver the right quality that we want as an output for our consumers.

Q440 The Chairman: In a sense, you are acting as your own extension service.

Martyn Jones: Effectively, yes. It is being done because we have that relationship with those producer groups and because we are acting as the conscience of our consumers. Part of our licence to trade and operate is that we keep our product at the right quality, as affordable as we can make it for the consumer, and ensuring that they can buy it with as clear a conscience as possible. They are also interested in sourcing locally or British, in animal welfare and in climate issues. That is a by-product. If they can buy meat or other produce from us knowing that that has gone on in the background, it makes it an easy choice for them.

Q441 The Chairman: One final question: are you unique in the United Kingdom or Europe as a major retailer in having this structure?

Martyn Jones: To our knowledge, we are unique in the UK in our vertically integrated model. I can only think of one other European supermarket chain, Migros in Switzerland, who are as vertically integrated as we are.

Q442 The Earl of Caithness: I would like to change the subject to food waste. We in our household throw away a huge amount of food unnecessarily. How much food do supermarkets throw away and what can innovation do to stop that and to help us to throw less food away at home?

Martyn Jones: Food waste is an equally interesting topic from our perspective. First, it is a cost. Hence our retail model includes what we call Market Street, which is a series of counters around the periphery of our store, which includes things like a salad department. We are using produce that may be coming up to its sell-by date, although it is still perfectly fit to use, to make salads and sandwiches in-store. From a consumer perspective you cannot get fresher than a product produced that day, but equally from a waste perspective it means

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

that we are able to control and manage waste in our produce departments to good effect. That is just one example.

In terms of the consumer, we run a programme in store called Great Taste, Less Waste. We produce a series of recipe cards, which are refreshed monthly, telling customers what to do with particular leftovers. We give them some practical recipe ideas to make use of that product.

The third thing that we do is that, because we have these counters where we sell meat, bacon, fish or delicatessen produce, if people want to buy one sausage, one slice of bacon or one slice of meat, they can come to our counters and have that. People can buy as much or as little as they choose to buy through our retail model.

Q443 The Earl of Caithness: How much food does Morrisons throw away or have to dispose of each year and what is the cost to you of that?

Martyn Jones: That is a very good question, with a certain commercial sensitivity.

The Earl of Caithness: Would you like write to us?

Martyn Jones: I would be reluctant to give you the figure, but suffice to say, we are industry-leading in our waste management and reduction, because of the way that we operate our stores.

Q444 Baroness Howarth of Breckland: I should start by saying that although it is not a declarable interest at this time, I should declare that I was for seven years with the Food Standards Agency, as a member of the board from 2000 to 2007. Tim knows this, but I have to declare it as a past interest.

I am very interested in public attitudes to innovation. It has already been mentioned this morning by our representatives from Morrisons. The FSA written evidence referred to a March 2009 report that you commissioned about public attitudes to emerging food technologies. You said that, “the main findings were that public attitudes are largely unsupportive of new technologies in food production, although there is a large middle ground of individuals who do not have fixed views.” Apart from commenting on that, would you also comment on the question that I asked earlier about whether you think that, since your report, attitudes are moving on even further? Can you say something more about the relationship between the consumer’s knowledge of food technologies and their opinions about them? You say in your evidence that that is ambiguous. You also say that, “innovation in agriculture is driven by a range of factors but the adoption of any new technology will ultimately depend on its success in the market, which is in many cases dependent on its acceptance by the end consumer.” How far is acceptance by the end consumer a dynamic factor? Who or what increases or decreases such acceptance?

Tim Smith: As you well know, the agency is primarily there to protect consumers’ interests in relation to food. Our interest in emerging technology is largely narrowed down to GM, novel foods and animal feed, which is where most of the innovation has happened in recent times, and to nanotechnology.

As a general opening comment, I think the public is, probably on an anecdotal basis—I will talk about the social science in a moment—wary, uneasy and uncertain about new technologies in relation to food. They are thinking what the risks and benefits to themselves and their families are when buying new foodstuffs. There is a hierarchy of acceptability of what is being done to food, which we detect in our research. That starts at the microbiological level, where people are less concerned, and then grows in significance when

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

you get up to large animals and humans. Those of you who followed the story about animal cloning will know that consumers in the UK were concerned about cloning not, from the FSA's perspective, because of food safety, but because of concerns about ethics and animal welfare. The uncertainty and the wariness about what happens in the food chain is particularly high.

Our sense is that the evidence review that we have commissioned is ambiguous because consumers have opinions about food without necessarily having knowledge. They very frequently do not change their behaviour as a consequence of their attitudes, or indeed what they report their attitude or behaviour are likely to be. We see that particularly in relation to price.

Social science is a little bit new to the agency, as Baroness Howarth will know well. We are based on science and evidence and only in the last two or three years have we concentrated our efforts more on social science, so this is an emerging area of evidence for us. A lot of research has been conducted in the area. We looked at 419 sources, to be precise, for our review. About half of those were about GM and biotechnology generally. It is difficult to explore in a survey situation for us, because there is low knowledge and understanding among consumers and, not surprisingly given that fact, a low interest. In a survey that we did, 29% said that they had heard of nanotechnology and only 19% were able to offer any definition³⁶. I am not in the least bit surprised by that.

While some people have quite firm views, the majority are undecided about new technologies and feel that they do not know enough to offer an opinion. We have seen a growing trend towards not what might be described as apathy, but those with an undecided or no view. We continued to track views on GM in the British Social Attitudes survey. We got 17% of people who said that they were pro-GM, 31% were anti, but the growing number, 53%, were undecided or had no view. We have seen that figure grow over the years.

The problem that we have in garnering evidence from consumers is partly their lack of trust of those people who are giving them information. They would highly trust, for example, doctors, friends, family, consumer groups and retailers. They would less often trust the media, Government and the processing industry generally. We, as the agency, are pleased that our trust level is at about 65%, but we do not offer many opinions, unless something new comes along, about whether a food is safe or not. With that concern, the social science evidence is building for us, but it is from quite a low evidence base.

Q445 Baroness Howarth of Breckland: We have been talking about partnerships and who in those partnerships can help understanding. In some ways, you are the Government, like we are the Government. You have had a tremendous influence in the salt campaigns and work on sugars and fats. What else do you think the agency can do to help people to think about innovation, not necessarily promulgating opinions but helping people to think about the issues?

Tim Smith: What we have found tremendously useful is what the experts call deliberative consumer research. We do that by gathering large numbers of people together and asking their opinions about a particular technology. At the moment we are doing that on nanotechnology. Large groups of people are invited along. It is not like focus groups; we do not just take their views and then go away and analyse it. We then input from experts on all

³⁶ NOTE BY WITNESS: These figures are given in an evidence review that was commissioned by the Food Standards Agency, and were taken from existing research.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

sides of the argument what is known and what is unknown about that particular technology and the impact it might have on people's lives. Then we ask consumers to judge for themselves whether their attitudes, and therefore their behaviour, may change as a consequence of having that information.

That would be even more useful in the GM field, where we have tracked the evidence about consumer attitudes and begun a piece of deliberative consumer research designed to tell us, in a relatively small group, but certainly into the hundreds, how attitudes might change, given the right information and the balance of facts that were available³⁷. You are quite right that the reason why we are seen as the right people to do this is to do with the high trust factor. Despite the fact that we are part of Government and therefore you might anticipate that we would attract some mistrust, we end up being the arbiter of who is capable of providing information to consumers so that they might tell us about their attitudes and behaviours to a particular technology.

Q446 Baroness Howarth of Breckland: How do you scale that up?

Tim Smith: It is a very difficult thing to do. In the end, the retailers and processors make a decision to have a food approved and test it in the marketplace, as happened with GM tomato paste way back when Safeway and others tried it. In the end, the market will decide. You have to go from the deliberative consumer research all the way through to somebody getting approval, in the safety sense, for a novel food. Somebody has to be brave enough to try that, because only then will you get the mass market answer. The key thing here is where do consumers have an interest? They only really have an interest when it has a direct benefit to them.

Q447 Baroness Parminter: Is that just around the implications vis-à-vis people's health, or do you touch on the broader issues around ethics and animal welfare? You cannot be the Government if you only look at one aspect of the debate.

Tim Smith: I have to answer that in two parts. Our remit is specifically in relation to public health and food safety. However, it would be a rather odd piece of research, for example on cloning, that did not then take account of the views of people on ethics and animal welfare. Our report on animal cloning, which deals with food safety, does not pass over the subject of ethics and animal welfare lightly, but that is for others to determine.

Q448 Baroness Howarth of Breckland: I will move on to Sue. In a paper last autumn on *Animal Cloning and Food Production*, your organisation says that, "It is essential that a consumer-focused approach is adopted that enables consumers to have confidence in the milk and dairy products that they are buying and make informed choices." Looking more generally at consumer attitudes towards innovation in food production, can you say more about your organisation's findings about public attitudes? Is innovation in agriculture and food a dirty word to consumers? Are some innovations good and some bad? What makes the difference to the attitude?

Sue Davies: Which? has carried out a lot of consumer research over the years. We have tended to track new developments in the food chain as well as looking at broader consumer issues. Over the years we have done a range of surveys and focus groups looking at GM foods, for example. We did the research that you mentioned on cloning. About two or

³⁷ NOTE BY WITNESS: This research was undertaken in 2009 and involved in depth interviews with 30 individuals who had been part of the 2008 British Social Attitudes survey. Twenty of these individuals went on to take part in the deliberative research.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

three years ago we also did a citizens' panel on nanotechnologies to try to understand the implications for consumers, looking at food in the context of other applications, such as medicines, cosmetics and other kinds of consumer products.

From our research, we certainly do not get the impression that innovation is a dirty word for consumers. On the one hand, we all like to try new things. It is a hugely competitive food industry. We are constantly seeing new products on the market that are more convenient or are telling us that they have particular health benefits. We have seen all the brilliant stuff that you mentioned happening on salt reductions, in innovation around reformulation. Where there are issues, as Tim mentioned, it is where people have concerns about the balance between the risks and the benefits; that is, risks in terms of safety, but also in terms of potential broader social or ethical issues.

Cloning, in a way, is obviously going to be quite controversial, because you are dealing with animals and therefore with quite strong ethical and animal welfare issues that some people are going to have concerns about. A survey that we did on it a couple of years ago showed that only 13% thought it was appropriate to use cloning in animal production and 91% felt that if products from cloning were on the market, they wanted to know about them. That was the same for products from clones and products from the offspring of clones.

The nanotechnology research that we did was interesting, because we used a deliberative method in which we exposed people to a whole range of different perspectives over three days. To start with people were quite excited, then they went quite cynical and by the end of it they had quite a balanced view overall. Food was one of the more sensitive issues, because people eat it. That was followed by cosmetics. On things like medicines, for example, people saw the risk-benefit balance in a different way and tended to be more enthusiastic about medical applications. With all the research we have done over the years, it comes down to what level of reassurance people have that the issues have been thought through and whether we know what the long-term implications are, and that we have effective independent oversight in order to deal with those. The issues that have tended to be really controversial are the ones when people have found out about them quite late and have found out that it is already having a big impact on what they are eating and they do not have an informed choice. Going back to the tomato puree example, we would probably have been in quite a different situation with GM if we had followed that approach. Instead, everybody suddenly found that they were eating soya that they did not know about and they found that GM was already widespread in a whole range of foods. We have had a similar situation with cloning. It comes back to really early engagement and debate with the public about these issues to try to understand and address those concerns proactively. People are then likely to be a lot more accepting of these technologies if they can see benefits.

Q449 Baroness Sharp of Guildford: This is a question that I would like to put to the whole panel. In the evidence we have just had from Professor Lillford, he said that things have changed over the last few years and that we are now confronted by what he called the alerted consumers, who were making considerable demands. They were more fastidious, in many senses; they looked at the labels, and so on. Is this something that you would go along with? Has there been a change over the last decade or so?

Sue Davies: Generally, people always want to know about what they are eating. Food production has become a lot more complex and we tend to rely on a lot more processed foods that are coming from all parts of the world. People want to know more about this and about the methods of production. They want to know about the country of origin and the nature of the ingredients. So I would say that probably is the case.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Tim Smith: From the agency's perspective, what we find reported is people taking an idealised view of what they think their shopping habits are and quite significantly under-reporting price, for example, as a key determinant. Top of all our surveys when we do them are quality and freshness. There is a growing interest in provenance, as I am sure our friends from Morrisons can talk about more eloquently than I do. Those who are interested have got more interested, but our sense is that the people who are not interested until they have had the risks and the benefits explained to them in a direct way that impacts on their lives tend to back off on thinking about the innovation at all. As Sue said, the danger with that is that an innovation occurs and it is then discovered as opposed to being introduced.

Q450 Baroness Sharp of Guildford: In Morrisons, do you feel that there has in any sense been a change in consumer alertness?

Martyn Jones: Absolutely, in terms of the availability of information, which is readily accessible via the internet, and from an education system that is bringing informed children through who are being educated to inquire and try to understand where things are coming from and the ethics behind production. You have this growing base of consumers with varying degrees of information. There is a saying that a little information can be a dangerous thing. Sometimes, opinion-formers can create an opinion that is not backed up by fact, in some cases. The lesson to be learnt from GM is that the more that information is shared with the consumer and the public at large early on about the background to why certain developments or innovations are coming through, the more chance it has of being accepted and successful, provided that it is safe. I am interested in selling safe, fresh food to consumers. Therefore I am reliant on the best scientific evidence of the FSA and so on and on research to tell me, as a retailer, and my technical team that this product is safe. I can then reassure my consumers that the product I am offering is safe. Unless the consumer is convinced, I am not going to offer it, because I am not going to offer a product that I am not going to sell.

Interestingly enough, a story about a GM lab creating a chicken that cannot spread bird flu was announced some time before Christmas. I picked up on that, as a retailer. Here is a development, using GM in chickens, that potentially benefits animal welfare because the chickens are less prone to getting avian flu. It reduces mortality rates in flocks, which then makes them potentially more sustainable and affordable and ultimately could give us a welfare benefit and affordable chicken to produce in this country. Would I sell that product? No. Until the consumer gave me permission, I would not offer it. If they then gave me permission, I would offer it and clearly label it so that they could have the choice to buy it or not, but at the moment, I would not even offer it, because I have not had permission from the consumer to do so. That is an example of an innovation that has not yet hit the market, but which potentially could benefit producers of chicken, as well as the chickens themselves.

Q451 The Earl of Caithness: Very briefly, if you are not going to put it on the shelves, who is and how can the consumer tell you?

Martyn Jones: That comes back to this route of informing the consumer of the benefits and the risks associated with that innovation. That can be very difficult, because sometimes they are quite complex subjects. As you say, a lot of consumers are more interested in the convenience, quality and price, but a minority of people are also very interested in the ethics and the welfare. It is about how you get that balance. As a retailer, I just have to deliver what my consumer wants and is prepared to buy.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Q452 Baroness Howarth of Breckland: Very briefly, so that we have it on the record, you were implying there was a role for the media. I wondered if you had a view about that role in influencing attitudes.

Martyn Jones: As a responsible retailer, I expect the media to be responsible in the way that they report these issues, and to do so factually. If it is safe, they should report it as safe. If it is not safe, they should report it as unsafe.

Q453 The Chairman: And you have never been disappointed by the media in that respect?

Martyn Jones: Suffice to say, safe is not newsworthy.

Q454 Baroness Sharp of Guildford: Can I move to the issue of innovation in agriculture. As you realise, our inquiry is set within the context of the development of European agriculture. In its November 2010 communication on the CAP towards 2020, the Commission places considerable emphasis on the importance of innovation, in the context of helping agriculture to meet the challenges of climate change and in order to boost the productivity of European agriculture. I would like to ask the panel as a whole how far you think that the overarching need for innovation is understood by different actors in the food chain—the producers, the processors, the retailers and the consumers. What role do you think should be played by the Government and its agencies in explaining this? Who else should be involved in raising awareness and understanding? And how far would you advocate any changes to EU policy to assist innovation in EU agriculture? Mr Evans, would you like to start?

David Evans: My view on innovation is that generally we are talking about issues that take 10, 20 or 30 years to prepare. Basically, that is not so well understood at the consumer level, but as you move more towards the producer level, they are becoming more aware. It is a bit like, “If it is not broken, don’t fix it”. There is a view that if it is okay now, we have to go forward. The Government and its agency played a major role and I think that’s great. It also helps to have industries understand where innovation is needed. That certainly helps my job, because when we talk to our supply chains we are fully aware of the issues, we just have to try to work out how we do it.

In terms of how I would respond to a change in EU policy, we know that we are moving the common agricultural policy budget away from the single farm payment. The budget has got to be reduced. For EU agriculture to be competitive and efficient, it needs to innovate. It is a bit of a cycle. It has to innovate to be able to accept lower payments. That is why I feel that our programme is great. It would be great if we could get EU support for people like ourselves. We manage a substantial amount of the British supply chain and we work directly with the producers, so we would like some funding to help our guys to be innovative so that they can make the transition in the CAP reform process.

Sue Davies: I think there is a need to try to widen out the debate about some of the challenges we are facing in the food chain so that consumers are much more aware. With the Foresight Report coming out setting out the huge challenges and the urgency with which we need to act, there are lots of discussions in some fora about some of the trade-offs that need to be made. We conducted some consumer research on food sustainability last year. People are aware of some of the issues—they might pick up on fish sustainability or palm oil for example—but in terms of how you join up the broader issues and move to a more sustainable, healthy supply of food, reducing the environmental impact and producing more food – as well as some of the issues within that around potentially reducing greenhouse gas

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

emissions, what that would mean for animal welfare and where you should draw the boundaries, there needs to be a much broader-based debate. The Government has an important role in leading and facilitating that. The role of new technologies and innovation fits within that.

We have often had concerns that if you have debates around innovation starting with whether the technology is good or bad, you are not really going to have the sort of discussions that you need. It needs to be Government-led, but it can be facilitated with all the different actors across the supply chain. It also needs to be integrated more effectively as part of the research agenda and priority-setting. We often talk about the need to engage with the public and to do more deliberative work. There are examples of good practice in some cases, but it is a question of trying to share those and broaden them out. We still often struggle with how we actually do it.

On the EU policy question, I should probably mention that in a personal capacity I am the vice-chair of the European Food Safety Authority Management Board, so that you do not think I have a conflict of interest. The EU obviously has a big focus on innovation. The same principles apply there. It is about responsible innovation and moving ahead in a way that recognises that if you do not have public acceptability, as we have seen with GM, you are not going to get anywhere if people do not want to buy the products at the end of the day.

Obviously, the issues underlying your inquiry are around CAP reform. We support major reform of the CAP and moving towards a consumer-focused food policy that is market-driven. There is also much more that needs to be done on anticipating some of these developments and making sure that we have the right regulatory framework in place. We are seeing this all play out again with nanotechnology, in the same way that we saw with GM food. We have done some research. People are quite open to it in some aspects, as long as the right controls are in place, but when you try to talk to the food industry, as the House of Lords Science and Technology Committee emphasised, and ask what is happening, there is a reluctance to talk about it because people think that everybody is going to be frightened and they are going to reject it. So we get into this horrible vicious cycle where companies do not want to talk about it at an early stage because they think that people will react, and then precisely because they do not talk about it at an early stage, people are going to think, "Well, if it was so good, you would have told me about it earlier in the process." With cloning and with nanotechnology, as with GM, we are often playing regulatory catch-up. It is about trying to be more forward-thinking and anticipating the developments that are in the pipeline.

Q455 Baroness Howarth of Breckland: I do not know how to ask this question without it sounding loaded. In terms of leading the way people are thinking, if large institutions like the EU set a moratorium on something, as they did on GM through regulation, does that not influence public attitudes? People look to those institutions and think that there must be something wrong if the European Union has set that regulation. I know that things have moved on, but that is an example of a generality. Regulation can have benefits of protecting in relation to risk, but also in stifling innovation.

Sue Davies: It has to be proportionate. GM is an example where we could have anticipated the developments that were taking place in America, but nobody really did, whether that was regulators or the industry itself. So we ended up with a huge amount of public concern about it. People did not want to eat it because they were not convinced of the benefits. The regulation was put in place after the event and was constantly updated, trying to deal with the developments as they evolved. We are seeing something similar with cloning. The novel

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

foods regulation is stuck in conciliation and unlikely to be resolved, because you have this big difference of opinion between the European Parliament and the member states about how it should be regulated. We have known that cloning has been going on in America and South America and other parts of the world for probably the last three or four years, and that products are on their way. It was always going to be an issue of huge public concern. Now we have an issue where the public become aware of it once it is already in the supply chain and products have potentially gone into the food chain. I agree that it has to be proportionate. Part of that is about trying to anticipate development and put in the right level of regulation early enough in the process, and being open about them in labelling. Often, there are arguments that labelling is a warning, but it should be seen as completely separate from the process of assuring safety. It is about genuinely informed choice on what you are deciding to eat. Therefore, as Martyn was saying, people can then be in a position to make an informed choice about whether they think something offers benefits.

Q456 Baroness Howarth of Breckland: I have one tiny point to follow that. When we had a discussion with the Americans about the technology, they thought we were totally mad in the way we processed these things through Europe, because of the way regulation was playing catch-up all the time and we were being held back and not moving things forward. Do you see any streamlining happening in Europe on all that, particularly with the newly developed Parliament powers alongside the Commission?

Sue Davies: Again, it comes back to the same point, which is trying to anticipate some of these issues early enough and decide on an appropriate level of regulation. A lot of it comes down to having effective traceability systems in place at an early stage, which in the case of cloning, for example, could have been put in place but were not. That is why there are now some arguments for a moratorium, although we think that would be ineffectual.

The GM debate is interesting. From the point of view of a consumer organisation, we are very active within the transatlantic consumer dialogue, which brings together EU and US consumer organisations. They share the same kinds of concerns at consumer level. Their research shows that people are sceptical about the risks and benefits. Sometimes it is presented as US consumers being very pro-innovation and wanting GM whereas Europeans do not. In both cases, it is about having the right level of regulation in place and having a system where you can effectively balance the risks and benefits as part of the approval process.

Tim Smith: Our sense is that consumers in general have a very limited understanding of how the food that they eat is produced. That limited understanding about the food chain and the industry leads consumers to worry about why innovations are needed. What is it about chickens now that could be better in the future? If we had relied on consumers taking the lead, we would not have had a recipe dish industry or a sandwich industry. Those things just would not have happened, so somebody has to be brave.

When we talk to consumers about technologies and the benefits, they tend to have a view that food should be kept natural. That is the general sense. The idea of any food being engineered is a cause for concern. I can best illustrate this by going back to our friend the chicken. *Campylobacter* is a big problem in this country. It is the biggest source of food poisoning, with 320,000-odd cases in England and Wales alone in 2008, costing the economy about £540 million. We talked to consumers about that in big groups and asked them to talk to us about safety. It was a really important issue, particularly when that torch was shone in that particular dark corner. They were very keen to reduce the incidence of *campylobacter*.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

On a hypothetical level, it is quite possible that irradiation, as a new technology, could pretty much eradicate campylobacter in chicken on retail sale. I can pretty much guarantee without looking to my left that Martyn would not sell labelled irradiated chicken. The reason for that is because of the negative connotations and incorrect associations. When I did my degree in food microbiology, this was going to be the resolution to all those problems. Consumers can be quite contradictory. They can see why it would be important to eradicate something as important as campylobacter, but even though the risks from irradiation are tiny—if, indeed, they are measurable—they would not consider that to be acceptable.

Communication about technology, which I think was the last part of your question, has to be carefully considered. Picking up an earlier point in relation to the media, the good news is that they are less trusted than pretty much anybody else represented at this table. Retailers, consumer bodies and, thankfully, the FSA are more trusted by members of the public. Those publications that make a particular campaigning noise about food tend to hold sway on the observations of people, but they are not necessarily trusted. We need to think carefully about how communication about technology is done. Sue has mentioned this more than once and I would like to mention it again. We need openness and transparency about what is being researched and what is likely to come down the track. Nanotechnology is a perfect example where we have, largely to the sound of silence, asked for a register of all nanotechnology research that is going on, following Lord Krebs' recommendation, so that we can anticipate and get ahead of the regulatory piece that is needed by getting consumers in touch with exactly what is going on.

I would finish by saying that if nanotechnology did not give them any benefit and if GM does not convey any consumer benefit—the banana that does not go black or a cheaper loaf of bread—it is going to be quite difficult to get most mainstream consumers engaged in whatever that innovation might be.

Q457 Baroness Parminter: Can I ask two questions on research? Whoever wants to pick them up, that is fine. The first is around research priorities. Everyone we have spoken to, not surprisingly, has said that we need to maintain or enhance levels of funding in research. Some have argued for more money to go into applied research rather than basic research. I would be interested in people's views on where they see the priorities for research to deliver some innovation in agriculture. My second question is around ensuring that public policy priorities are factored into decision-making around funding for research, both public sector, government funding and private retailer funding. How do we ensure that we can factor in decisions around diet and around cutting global carbon emissions, even if that is not what the consumer is saying to you at present?

Tim Smith: Shall I start? Our focus, as I have said a number of times, is on food safety. We have a certain amount of research that we need to keep progressing with, particularly on the microbiological contaminants that cause us all the concerns that they do. If we set that to one side, we know that building on that fundamental scientific research is vital for those who do the applied work for us. The most interesting thing we have seen is a more collaborative approach. If those who have interests across the food supply chain are actively working together and actively funding research, which is a plug for our campaign on campylobacter, there are a whole range of people, including retailers and processors, who are involved actively in the research. Being involved in the research gives a sense of commitment and purpose to what would then follow the research. It is not just research; it never can be. It has to be something that is going to lead to activity. The more that we all share in that responsibility, the better it is, potentially, for an outcome that has everybody agreeing on what should be done next.

Food Standards Agency, Professor Peter Lillford, Wm Morrison Supermarkets plc and Which?

Martyn Jones: From my perspective, we are further down the supply chain, so the research that we are interested in is around how to deliver more efficient production of food, while at the same time making it more sustainable. The research that we are interested in also has to be driven by our supplier chain. As we said earlier, the people who supply us recognise the areas of pressure but do not have the wherewithal to invest in the research. Because of our position in the centre of the whole farming community, with £500 million spent on British meat alone, we are able to talk to that community in the round. Through the programme that we run, we are asking what are the key factors impacting their ability to produce this more profitably for themselves and in a way that is more affordable for us to sell. Those are the things that we will then invest in research in to make a practical application. We are interested in research that results in a practical application, not research that is deliverable 20 years down the line. I am interested in sustainable food supply now, not in 20 years. I am, of course, in the longer term, but that is for others to start. That is for the growers and producers to invest in for the longer term. I am there to invest in the short to medium term.

Sue Davies: On the priorities, we would be guided by the reports such as Foresight or the Royal Society. We need to tackle some of the really big challenges that we are facing, the global challenges around food security and sustainability, while at the same time making sure that we keep a focus on some of the more everyday things that people experience, such as the barriers to eating healthier diets, which low-income consumers are struggling with particularly. We need to make sure that we can have safe food and get better at trying to build in at an early stage in the research process the need to consider what some of the implications might be for the ultimate consumers, rather than waiting until the research is already quite advanced, and then you find that there are serious social or ethical concerns. That is done to some extent by the research councils, but it can be done much more effectively. We need to have a broader-based public debate about some of these issues and how we can take them forward. One of the concerns—nanotechnology is an example—is that there is a tendency sometimes to get very excited and for people to want to do the new, innovative research, but then often the research around the environmental risks, the health risks and other social risks does not keep pace. That certainly has been the case with nanotechnologies. The Science and Technology Committee's report said that we just do not know some of the basic toxicology, and yet products are close to market. We need to try to make sure that those things go hand in hand.

The Chairman: Thank you very much. On behalf of the whole Committee, I thank each of you for some authoritative insights and we are very grateful for your presence today. Thank you.

Mr Uffe Sveistrup, Danish Agriculture Attache

Oral evidence, 2 March 2011, Q 477-509

Evidence Session No. 13. Heard in Public.

Members present

Lord Cameron of Dillington (Chairman)
The Earl of Arran
The Earl of Caithness
The Earl of Dundee
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witness

Mr Uffe Sveistrup, [Danish Agriculture Attaché].

Q458 The Chairman: First, thank you for coming to see us; it is very kind of you to give up your time. I am sure that you have had to do some research in advance.

Mr Uffe Sveistrup: I have tried to.

The Chairman: Well done. This is a formal session that we are recording. You will get a transcript and can alter any small details or errors of communication that have crept in. The evidence will be published alongside our report.

The Danish Government have a very interesting Green Development and Demonstration Programme. Perhaps you could tell us where it came from, who initiated it, how it works, who funds it, who are the leaders and so on.

Mr Uffe Sveistrup: First, thank you for inviting me. I work as the agricultural attaché of the Danish permanent representation. I cover the whole of the CAP and am not an expert in any particular field such as innovation. However, I will present some of our ideas and thoughts in relation to innovation in agriculture.

Before I start, perhaps it would be useful to ask why innovation is important. It is clear from different studies that enterprises that engage in research, innovation and development have a higher level of productivity than enterprises that do not engage in such activities. In our view, it is clear that innovation is one of the cornerstones of securing the competitiveness of the agricultural sector, and a key instrument to meet some of the new challenges that everybody talks about, such as climate change and protecting the environment. Innovation is also part of the EU 2020 strategy. That is just to set the framework for our discussion.

The Green Development and Demonstration Programme is one of our main new initiatives in the field of innovation. It was started only last year, 2010. It is a purely national-funded programme and is part of a wider large-scale programme called green growth, which is financed to a large extent by rural development funds. I will concentrate on the Green Development and Demonstration Programme and then we can return to the broader aspect. The programme has the particular aim of combining two main objectives: to have projects that contribute to securing a high level of environmental protection but at the same time ensure that products are profitable and have a sound economic business profile. The main idea of this project is that we do not see these two objectives as contradictory. We find that only by combining these two objectives will we be able to enhance the sustainability and competitiveness of the agricultural sector. This also means that projects that focus solely on the environment or on the business profile are not eligible under this programme. The programme was initiated to combine the two main objectives.

This also means that each project has to be accompanied by a business plan which makes an estimation of the revenue and the wider economic effect, and also by a communication plan. Communication is another important aspect of the programme: to widen publicity of the project and its results and also to use this as a way to attract new, qualified applicants.

The programme is governed by a board. The members are recruited mainly from different kinds of private enterprises. They draw up a strategy and a development plan, which is approved by the Minister. There is a secretariat led by the ministry. The projects are chosen according to a list of criteria that reflect the two main objectives. In the context of the environment, the criteria concern reduction of CO₂ emissions, reduction of the surplus of nitrogen, reduction in the use of pesticides and so on. There are also economic criteria. Added value, revenue and wider economic factors are very important. These criteria are used to pick the projects.

Q459 The Chairman: But not increased food production, for instance?

Mr Uffe Sveistrup: Increased food production is not mentioned as a specific criterion, but it could be part of the result.

Q460 The Chairman: It sounds as though the programme is targeted specifically at reducing the environmental effect of agriculture rather than at enhancing output.

Mr Uffe Sveistrup: Yes, protecting the environment, but also securing profitability for the sector, which of course could lead to higher food production. I am not a research expert, but the main character of the research is that it is applied research, necessary to overcome a specific problem. It is not basic research, but targeted research; that is the main element of the programme. The budget is 200 million Danish krone, which is about £20 million, and it is a nationally financed project.

Q461 Baroness Howarth of Breckland: I would like to ask about the Danish Agricultural Advisory Service. First, how is the DAAS involved with the Green Development Programme? We understand that the DAAS national centre conducts research and development, and we would like to know how this work is aligned with the priorities that you have just been talking about.

Mr Uffe Sveistrup: The Danish environmental service is involved in the Green Development and Demonstration Programme. It is part of the dialogue and the process when the national strategy is developed. It also applies a grant from the programme and is engaged in projects.

Q462 Baroness Howarth of Breckland: How do you mean, it applies a grant? It receives a grant?

Mr Uffe Sveistrup: Exactly. It runs projects and participates directly in that way, and is also involved in the process of drawing up the strategic plan.

Q463 Baroness Howarth of Breckland: We understand that the service is privately run, that it is a national service, that the state subsidy is about 10 per cent of the budget and that the rest is provided by charging farmers for services. Has this proved to be a viable model? We are particularly interested in whether farmers have to make a payment or whether this is voluntary. How does it work?

Mr Uffe Sveistrup: Until 2004, there was a direct subsidy from the state, but that was abolished. Now it is in principle solely a privately run service.

Q464 Baroness Howarth of Breckland: So there is no 10 per cent subsidy any more?

Mr Uffe Sveistrup: No, but there is a pesticides tax and some of the revenue is transferred back to the service. The rest is funded by production levies on the sector. Basically, it is a privately run service and to my knowledge it has proved to be a viable model.

Q465 Baroness Howarth of Breckland: To what extent do farmers in Denmark get advice from other sources such as representatives of seed companies?

Mr Uffe Sveistrup: There is no doubt that the advisory service is the main player, but farmers also receive advice from seed producers and advisers. However, the main body is the advisory service.

Q466 The Chairman: Is the levy on farmers? Does every farmer contribute?

Mr Uffe Sveistrup: Yes, but I am not sure whether payment is obligatory or voluntary. I think it is obligatory.

Q467 The Chairman: So if you ask for advice about your farm, presumably you pay for that?

Mr Uffe Sveistrup: Yes.

Baroness Howarth of Breckland: Perhaps you could write to us on that, because we would be interested to know how it works.

The Chairman: Our on-farm advisory service has collapsed in the UK and we are looking for other ways of doing it. It would be very helpful if you would write to us on that.

Q468 The Earl of Dundee: Perhaps you could explain how GDDP could help with future food policy.

Mr Uffe Sveistrup: That depends on what you mean by food policy. When I think of food policy, I think of pure food policy—food safety and things like that. The GDDP is designed to focus on innovation in relation to the agricultural sector and the primary producers, to invent new production technologies and new products that will help to boost efficiency. That is the basis, rather than food policy in general. As I understand it, the EU research programme is focused more on helping big multinational enterprises that are involved in enzymes and food ingredients. Our programme is focused more towards the primary sector. It is not part of food policy as such, but it is part of the wider green growth plan, which also combines the objective of having a high protection level for the environment and securing an

appropriate framework for the sector to develop. It should be seen more in that context than in the context of food policy as such.

Q469 The Earl of Dundee: Could it not do both? If it is able to help small or mainstream farmers to be innovative and take everything into account, will they not get better at growing food? That may be the inferred connection with the benefit to future food policy. If that is the case, to what extent would you like to see the European Union and its member states adopting similar measures to those incorporated in your GDDP scheme?

Mr Uffe Sveistrup: We would like to see other member states engaged in projects like this. We see it as a key instrument also in the context of the future CAP. That is also why we have specific priorities and wishes when it comes to widening the framework of the present rural development regulations. Although it is possible to support innovation projects, and we have managed to get improvements, we do not think that the present framework is sufficient.

Returning to your question about food policy, if we engage in these new technologies, it could also enhance food production and be instrumental in securing the food supply. There is no contradiction, but the aim of our project is more to focus on the primary producer and the agricultural sector, and not so much on broader foodstuff policy.

Q470 The Earl of Dundee: The benefits to food supplies may be indirect from your GDDP scheme. Other countries such as the UK do not have such a scheme. If we did, perhaps that would be beneficial to each member state and to the European Union affiliation. Would you like to see your GDDP scheme adopted elsewhere?

Mr Uffe Sveistrup: I don't see why not.

Q471 The Earl of Arran: You have already alluded to the EU's research programme. How successful has been in supporting agricultural innovation? No doubt post-2013 you would like to see changes.

Mr Uffe Sveistrup: Yes. As I said, I am not an expert on wider research policy. However, it is my understanding that the framework programme has been directed more toward the food enterprises that engage in more hardcore academic research, and not so much to the applied research that is linked more to primary producers and farmers. There is an innovation programme, SIP, but it has not been useful for us; that is what my experts tell me. That is why we see the need, within the agricultural and rural development policy, to make changes that will give us more possibilities to engage in and support innovation projects.

Q472 The Earl of Arran: Would you like to see a European innovation partnership as one of the changes?

Mr Uffe Sveistrup: That could be one change. However, within Pillar 2 and the rural development programme, we also see the need for changes. That is partly because the agricultural sector is becoming more diverse and engaging in projects relating to green energy and other non-food products. Today, for instance, it is possible to support co-operation projects only if two or more individuals or entities are involved, even though a number of innovation projects are carried out by single enterprises. We find it very difficult to understand this restriction. Furthermore, there are strict restrictions on projects that involve products such as biogas that are not covered by annexe I, even though they contribute to agricultural activities. We would like to see non-annexe I products covered by these possibilities.

Another more general point is that increased support rates are necessary, because often substantial financial risks are involved in these projects. This point was raised by Mr Barroso in a speech to the European Parliament.

Q473 The Chairman: Does this relate particularly to energy projects like biogas?

Mr Uffe Sveistrup: That would be one of the main items, but I am sure there are other projects as well.

Q474 The Earl of Arran: So you would definitely push for more collaboration between member states?

Mr Uffe Sveistrup: Yes.

Q475 The Earl of Caithness: Perhaps I might take you on to the Common Agricultural Policy and the farm advisory systems. Member states are required under CAP to set up systems to support farmers with regard to cross-compliance. How does this work in Denmark, and how is it working in the rest of the EU?

Mr Uffe Sveistrup: We discussed this system in the special committee on agriculture just before Christmas. It appears that the system is used by very few farmers in the EU, and it is not of particular importance in Denmark. We do not see the farm advisory system as one of the main instruments for innovation. More direct measures are necessary. From our perspective, the advisory system could be useful in helping to guide farmers on cross-compliance requirements, which everybody agrees are difficult. In the context of innovation, it could act as a bridge between farmers and research institutions, helping them to access finance and acquire skills. It could have a role there. However, we do not see the farm advisory service as a major player in this field. I am not sure how it works in other member states; I cannot say much about that.

Q476 The Earl of Caithness: You referred to the bridge between researchers and farmers. A lot of evidence we have taken shows that there is great difficulty in getting information from research people out onto the farm. If you were able to redesign the CAP, what would be the Danish model that you would recommend? This is crucial for CAP's future development.

Mr Uffe Sveistrup: The elements would be the ones that I described: expanding the framework to cover non-annexe I products and single projects, and providing higher support rates. It is a good question about the bridge. The advisory services that we have on a national basis perform this role to some extent. As we have an EU-wide system, perhaps we should make better use of it. How we do that I am not sure. If you are interested, I will inquire whether we have any specific proposals to enhance the role of the advisory services. It is clear that a wider framework will be necessary to improve the level of innovation.

Q477 Baroness Howarth of Breckland: If you have an advisory service that is using funds and does not seem to be very productive, could you use those funds in a more specific and targeted way to improve the transmission of knowledge?

Mr Uffe Sveistrup: It is certainly a good idea that the services should be more focused and targeted. That would be a good way to go.

Baroness Howarth of Breckland: Rather than trying to get something that is not working to work.

Mr Uffe Sveistrup: I think so.

Q478 Baroness Parminter: In the UK, some farm businesses are less open than others to innovation. In Denmark, are there some farms and businesses that are less keen to take up innovation and develop productivity?

Mr Uffe Sveistrup: I am sure there are, but it is clear that some projects are not taken up for the reasons that I mentioned; there needs to be more than one actor, and the possibilities for support rates are too limited. We have examples of projects that have not been eligible for support for these reasons. There are limits in the present framework that hinder the potential that should be there for some enterprises, but there could be many other reasons.

Q479 Baroness Parminter: In the UK, we have looked at the need for better training and for more new people to come into the industry. In Denmark, have the Government made any specific efforts to attract new graduates and skilled technicians to the sector?

Mr Uffe Sveistrup: In the Green Development and Demonstration Programme, they are keen to meet potential applicants to explain the possibilities. They have drawn up inspiration papers on the possibilities and prospects to try to engage with applicants. So within the programme, there have been initiatives. I am not sure whether there have been more general initiatives to attract special kinds of educated people. Perhaps that is not for our ministry but for the Ministry for Science and Technology.

Q480 Baroness Parminter: Finally, on the issue of CAP, what should be done in the upcoming reform to change the CAP to encourage innovation?

The Chairman: In less than an hour!

Mr Uffe Sveistrup: As I mentioned before, it should be possible to support single projects that involve only one enterprise. We should have the possibility to support non-annexe I projects. It is also important to have high support rates that take into consideration the financial risks. Those are specific proposals.

Q481 The Chairman: What is the general Danish take on CAP reform, Pillar 1 and Pillar 2 and the crossover with research and development?

Mr Uffe Sveistrup: The general take is that we would like to see a reduction and then a phasing out of the direct payments. As that might not be realistic, we have taken the more intermediate, pragmatic approach that we should try to have added value from the direct payment. That means that we should take some of the area-based measures in Pillar 2 and transfer them to Pillar 1, making the direct payment dependent on more environmental conditions. In that way, we would create more room for supporting innovation in Pillar 2. That is the overall framework of our strategy towards the CAP negotiations.

Q482 The Earl of Caithness: Having two pillars is a hindrance to CAP. Would it not be better to have just one?

Mr Uffe Sveistrup: In the debate now, many people talk about not interfering and not having an overlap between Pillar 1 and Pillar 2. In our view it is more important what you put in to the pillar than what you call it. The key is to have more added value from the direct payment.

Q483 The Chairman: I am sure that is right. Most of us would agree with you. On innovation, we have heard from Commissioner Ciolos about the desire to make European Union agriculture more competitive and more productive in terms of feeding the world, which will be a major problem. At the same time there seems to be a reluctance to adopt modern techniques, with the recent ban on the cloning of animals, the restrictions on pesticides and the reluctance to accept GMOs. That seems to be a contradiction. What is your take on these issues?

Mr Uffe Sveistrup: It is a sensitive political issue. You mentioned cloning. You may be right that the proposed ban on cloning might hinder a more innovative approach. On the other hand, it is a political fact that we have to respect. To my knowledge, Denmark is the only member state that has a national ban on the use of cloned animals. It is a fact that we have to respect. If we take other areas such as biogas, there is plenty of opportunity in the present political framework to expand the possibilities. You also mentioned GMOs. We are eager to see a solution to the zero tolerance problem, but these are difficult and sensitive political questions.

Q484 The Chairman: What do Danish voters think about GMOs? If you could have national acceptance of this policy, looking carefully at each development, would the Danish Government risk accepting a GM potato that was blight-free?

Mr Uffe Sveistrup: It is a good question. I am not sure. You mentioned voters. If you did a vox pop, you would find many people in the street saying we should not have GMOs.

Q485 The Earl of Arran: Would that be exacerbated by the press?

Mr Uffe Sveistrup: Most likely.

Q486 The Earl of Arran: Are they very much against GM crops?

Mr Uffe Sveistrup: That is difficult to say. Some of the press are against GM, and green organisations in general are very much against it.

Q487 The Chairman: In the EU, do the different DGs—agriculture, research and development and even overseas development—combine well to deal with the question of food innovation, or is there competition between them?

Mr Uffe Sveistrup: That is also a difficult question. It is my impression that there is competition. One argument that we met from the Commission when we talked about expanding the possibilities for innovation was that we should be careful not to come too close to research and the structural funds, because that is another field. I guess there are some restrictions that stem from having different institutions with different political approaches.

Q488 The Chairman: Commissioner Ciolos came to a farming conference in Oxford last month. He was keen to promote competitive European Union agriculture, yet the R&D programme does not put much money into agriculture and the new European Innovation Partnership seems to be very slow to get off the ground. There does not seem to be much impetus behind this.

Mr Uffe Sveistrup: That is exactly why we would like to see more possibilities in the CAP. It is true that the Commissioner often mentions competitiveness, but in the same sentence he mentions small farmers. We agree that we should try to improve the competitiveness of

Mr Uffe Sveistrup, Danish Agriculture Attache

small farmers, but larger farmers are equally important if we are to have a real effect on innovation.

Q489 The Earl of Arran: What is the average size of a farm in Denmark? How many hectares are we talking about?

Mr Uffe Sveistrup: That is a good question. I will come back to you on that because I would rather give you a correct answer than a guess.

Q490 The Earl of Dundee: What is the rough percentage of farmers in the population of Denmark?

Mr Uffe Sveistrup: There are around 40,000 farms in Denmark, and the population is 5.2 million. Two per cent of the workforce work on farms.

The Chairman: Thank you very much for coming to talk to us. Would you like to add anything? Is there any point that we have missed?

Mr Uffe Sveistrup: No, you have been very thorough.

Supplementary written evidence (IEUA 39)

Danish Agricultural Advisory Service – a brief description

The Danish Agricultural Advisory Service (DAAS) is a partnership made up of 31 independent local advisory centres and one knowledge centre. This unique two-level advisory system is both owned and managed by Danish farmers primarily for the benefit of their members. The partnership employs approximately 3,450 staff (2009).

The aim of DAAS is to provide, first and foremost, Danish farmers with new knowledge in the best way and at the right time in order to improve efficiency and productivity in Danish farming and to improve quality of agricultural products.

The Knowledge Centre is a service organisation working in partnership with the local centres providing knowledge and innovation and technical support for DAAS.

The Knowledge Centre is the main supplier of professional knowledge for the farming community. A very important task of the Knowledge Centre is to bridge the gap between research and farming. The role of the Knowledge Centre is therefore to process and convey the latest knowledge from research institutions, private companies and educational institutions and others – to our clients.

Our clients are mainly the 31 advisory centres that we are closely connected to in the partnership of Danish Agricultural Advisory Service, but also food companies, public authorities and agricultural colleges are in the client group. In a few areas, we also have farmers and other agriculturalists as our direct clients.

Among other things, our customers benefit from our close co-operation through:

- Highly specialised advisory services which match the needs of individual farmers
- Full-range of services at all local advisory centres
- Access to the most recent products and methods
- Advisory services at competitive prices owing to rational procedures
- Products developed to match the actual, local requirements.

The history of DAAS dates back to around 1875 when farmers' organisations started to employ their own advisers. Today, DAAS is one of the leading agricultural advisory services in Europe.

The Knowledge Centre is owned by Danish Agriculture and Food Council which is a national body representing farming organisations and the food industry at the national level. The Knowledge Centre is owned by farmers through their membership of farming organisations.

Local Centres

There are presently 31 independent local centres spread throughout the country providing advisory services to about 45 000 farmers (full time and part time). The local centres provide advisory services in all aspects of the farming business.

The principles of DAAS are that:

- It is owned and managed by the users, via their membership of farming organisations
- It is user paid
- It provides advisory services in all aspects of the farming business
- It is officially and universally recognised as impartial
- It has no inspection tasks on behalf of government

Capability statement

We put knowledge into work

Farmers are both owners and users

DAAS, The Knowledge Centre is owned by Danish Agriculture and Food Council which is a national body representing farming organisations and the food industry at the national level. The Knowledge Centre is owned by farmers through their membership of farming organisations.

A strong base of support

DAAS, The Knowledge Centre is organised into thirteen specialised professional departments, where it plays the role of a research & development centre, serving as "adviser to the advisers" and "trainer of trainers" in a two-level advisory system. The primary task of DAAS, The Knowledge Centre is to provide technical know-how and support service to the 31 local advisory centres, owned and managed by the local farmers' organisations. The main areas of support to the local advisory centres are:

- Specialised advice
- Dissemination of know-how
- Development activities
- Experiments and studies
- Education and in-service training
- Human resource development
- Service tasks

The local centres provide advice, training and information on technical, economic, educational, IT and social issues to the farmers.

Specialised advice

Specialised advice is the "core service". It comprises advice on for instance norms and standards, whether for feeding, fertilizing or for building design, animal welfare, plant protection, product efficiency and quality and much more. In many cases these official norms and standards are developed by DAAS, National Centre on basis of field trials and other registrations. In general DAAS, National Centre's aim is to provide a basis for local advisers to assist the farmers so that they can earn a satisfactory income and at the same time live up to the politically defined targets.

DAAS, The Knowledge Centre has the status within EU of Mandated Body to undertake several activities which, in most countries, typically would be handled within the central administration. Examples are:

- Farm Accountancy Data Network (FADN):
DAAS, The Knowledge Centre keeps databases of 80% of Danish farmers' account

data. This forms the basis of FADN work in Denmark

- Animal identification and herd registration:
The EU legislation enforced since 1992 is based on the Danish herd and animal identification system, developed in the 1960s, and DAAS, The Knowledge Centre is on behalf of the Danish Ministry of Food, Agriculture and Fisheries undertaking this registration in Denmark

DAAS, The Knowledge Centre's staff holds distinguished competence in a number of technical areas such as livestock breeding, land consolidation, agricultural financing, animal recording, fertilizing, rural development, biogas, ICCP, HACCP, project management, fund-raising, eLearning, IT systems development, disease prevention and surveillance, organic farming, code of good agricultural practices etc.

Due to competence in these areas, DAAS, The Knowledge Centre is represented in numerous official, semi-public and autonomous committees, workgroups and networks, for instance:

- ICAR (International Committee for Animal Recording)
- The Organic Food Council
- The Neuchatel Initiative
- The Research Committee for Agricultural Engineering

DAAS, The Knowledge Centre is through the owners, Danish Agriculture, included in the policy planning and programming process and DAAS, The Knowledge Centre has close relations with ministries and public authorities. When trade organisations are engaged in negotiations concerning new environmental requirements or modification of subsidy rates etc., the experts at DAAS, The Knowledge Centre often provide professional backing. This also applies when amendments to legislation have to be translated into government orders and circulars.

Dissemination of know-how

Today the main channel of communication of knowledge is the internet. All advisers and farmers can access "LandbrugsInfo" (in English "WebInfo"), DAAS, The Knowledge Centre's internet portal with more than **50,000 documents on agricultural issues, including "RegelInfo" (information on rules and legislation)**, several internet based, interactive applications such as **"Plantprotection Online"** and eLearning offers.

Knowledge is communicated through meetings, seminars, pamphlets, annual reports, special reports, handbooks and CD ROMs, e.g. Agrimach which contains data on about 40,000 farm machines. The employees write articles for the agricultural magazines, participate in experience exchange groups, hold meetings and give lectures in local farmers' organisations etc.

Development activities

Interdisciplinary cooperation is a precondition for providing modern advice. DAAS, The Knowledge Centre carries out a number of development projects in a special projects organisation consisting of employees from professional departments. Good examples of this are projects on green accounting, environmental and resource management, as well as

quality assurance in connection with complete certification and documentation of contract production.

INTEGRATED FARM MANAGEMENT SYSTEM is the name of a comprehensive computer program for production management on farms, developed by DAAS, The Knowledge Centre. Development of new breeding programmes, housing systems and advisory methods are other examples.

Experiments and studies

About 1,300 local field experiments are carried out in close cooperation between the local centres and DAAS, The Knowledge Centre every year. They provide for instance information on the yield of different plant varieties and their response to plant protection and fertilisation in relation to variations in soil types and climates. The results are available for the farmers and advisers immediately after the growing season so that the experience can be used the following year. DAAS, The Knowledge Centre is the fastest organisation to communicate knowledge in this area worldwide and has a strong focus on assuring the quality of the experiments.

In the field of farm buildings, machinery and technique FarmTests are carried out among the users of different types of tillage equipment, housing equipment and farm biogas systems etc.

The everyday work in the professional departments also comprises some more specialised experiments: crops for non-food purposes, application of flax and hemp for insulation, scanning of muscle and fat thickness in lambs, alternatives to antibiotic growth promoters and analyses concerning increased productivity and reduced costs are some examples.

Education and in-service training

DAAS, The Knowledge Centre has a comprehensive production of textbooks and teaching material for the basic education of farmers, and it organises educational work for children and young people in agriculture.

Our in-house publishing house, "Landbrugsforlaget", has organised the production of about 50 textbooks for the basic education of farmers at the 10 agricultural schools and it prepares teaching material as well.

Furthermore, the professional departments have independent activities, e.g. professional seminars, excursions and experience exchange groups for advisers etc.

Service tasks

DAAS, The Knowledge Centre handles many different service tasks for the advisory service collectively as well as for the farmers.

An annual nitrogen forecast is prepared by DAAS, The Knowledge Centre. This forms the basis for calculating fertilisation standards, and in cooperation with the Faculty of Agricultural Sciences at Aarhus University, DAAS, The Knowledge Centre issues current warnings of plant pests in the growth season via the internet.

Other service tasks include milk recording of dairy cows, herd-book keeping and ear tag administration for several livestock breeds, as well as potato seed control and export certificates.

Several professional departments function as secretariats, serving e.g. breeding associations and various standing committees.

Farmer-elected management

The farmers are deeply integrated in the work of DAAS, The Knowledge Centre which is a division of Danish Agriculture, the national farmers' organisation. The authority to manage DAAS, The Knowledge Centre rests with the board of this organisation. All the professional departments have a national committee to point out and prioritise the professional tasks. The members of the national committees are farmers who have been elected by the farmers' organisations.

Cooperation partners

Research

DAAS, The Knowledge Centre bridges the gap between agricultural research and primary farming. New know-how should be put into use on the farm and in the field as quickly as possible, and DAAS, The Knowledge Centre therefore cooperates closely with the national research institutions conducting agricultural research, e.g. Faculty of Agricultural Sciences at Aarhus University and The Faculty of Life Sciences (LIFE) at Copenhagen University.

Organisations

The farming sector's own organisations are also cooperation partners. In this connection DAAS, The Knowledge Centre drafts proposals for all the research that is concerned with primary farm production.

Authorities

DAAS, The Knowledge Centre has close relations with ministries and public authorities. When trade organisations are engaged in negotiations concerning new environmental requirements or modification of subsidy rates etc., the experts at DAAS, The Knowledge Centre often provide professional backing. This also applies when amendments to legislation have to be translated into government orders and circulars.

European Commission

Written evidence (IEUA 29)

Executive Summary

Innovation plays a key role in the Europe 2020 Strategy. The role of Government is to provide the framework conditions to better turn innovative ideas into competitive products and services. The CAP creates such framework conditions by ensuring that farmers act in a competitive environment, decoupling direct payments, setting high production standards, granting support to investment and by giving advice and training. Agricultural markets are increasingly liberalised and farmers therefore have every incentive to be entrepreneurial. New societal challenges (e.g. climate change, sustainable resource management) are an opportunity for the sector to provide innovative public goods. Innovation in agriculture is a central means to meet the strategic challenges the agricultural sector is facing today, such as increasing productivity and competitiveness fostering green growth and contributing to the vitality of rural areas.

Innovation systems and policies across the EU are diverse. Their performance is currently being analysed and reviewed by the Standard Committee on Agricultural Research (SCAR). There are important obstacles which continue to hamper innovative practices and products in European agriculture. These include the difficulty of transferring new skills and techniques to farmers, many of whom lack formal training. This is why Commissioner Ciolos is of the view that mainstreaming innovation across the CAP's rural development policies should be a key priority for the future CAP.

Many of the sector's shortcomings are already addressed' through various rural development measures. Main rural development measures supporting training and skills include vocational training, advisory services, general training and information related to rural development outside farming and forestry and skills acquisition, animation and implementation. Research results are disseminated through the European Network for Rural Development (ENRD). Moreover, each Member State is legally obliged to set up a national Farm Advisory System offering applied advice to farmers. Special attention is given to the situation of young farmers taking into account their positive input in the future of EU agriculture. Measures include assistance to the setting up of young farmers and to the modernisation of agricultural holdings.

At European level, agriculture's main link to the Seventh Research Framework Programme (FP7) is through the "Food, agriculture and biotechnology" thematic priority, specifically devoted to the technological challenges facing European agriculture. In the context of developing the European Research Area, agricultural research is a key priority, coordinated by SCAR. In the currently developed Innovation Union, a major initiative of the Europe 2020 Strategy, agriculture will need to relate to the instrument of European Innovation Partnerships. Their objective is to tackle a societal challenge by aligning expertise, resources and policies at EU and national levels in order to speed up research and create a favourable regulatory framework to reach a specific, pre-defined target.

I. DEFINITION OF "INNOVATION" IN THE AGRICULTURAL CONTEXT

Under the Smart Growth priority of the Europe 2020 strategy³⁸, innovation is identified as having a key role in achieving sustainable economic recovery. Strengthening knowledge and innovation are seen as drivers of future growth requiring improvement of *"the quality of our education, strengthening our research performance [and] promoting innovation and knowledge transfer throughout the Union"*. This emphasises the growing perception of innovation as a socio-economic rather than technological process.

The Innovation Union initiative more specifically aims to *"improve framework conditions [...] so as to ensure that innovative ideas can be turned into products and services that create growth and jobs."* This focuses on the ability to turn innovative ideas into products that everybody will want to buy and to enable EU companies to be first in the market. Thus, innovation does not only consist in innovative ideas or products alone, but depends essentially on dissemination and uptake of innovation. Competition is seen as a motivating factor to invest resources in innovation.

The policy framework provided by the reformed CAP has created many of those conditions in which innovation in EU agriculture can take place and can be improved:

- A competitive environment: Gradual liberalisation of agricultural markets, including lowering of price support, has exposed the sector to competitive pressure in a globalised economy.
- Choice in production orientation. Accompanying this process, the decoupling of direct payments from the obligation to produce a determined product has opened up the sector to diversification of farm and, to a lesser extent, non-farm activity.
- High Production Standards. At the same time, through linking of decoupled direct payments to compliance with EU standards laid down in environmental, safety and quality legislation, improvement in EU agricultural methods has been required.
- Access to support for innovation and investment. Rural Development policy has evolved to provide a number of measures for farmers and rural citizens to develop innovation through improvements in competitiveness, including training and investments, development of targeted agri-environmental solutions and diversification of the rural economy.
- Advice at farm level. Each Member State is legally obliged to set up a national Farm Advisory System offering applied advice to farmers.

2. INNOVATION IN EU AGRICULTURE AS A STRATEGIC OBJECTIVE

With the overall context of the Europe 2020 Strategy and the policy setting provided by the reformed CAP innovation in EU agriculture appears less as an objective in itself but rather as a means to reach strategic objectives of the CAP. Innovation should be further encouraged as a way to find solutions to the following challenges facing EU agriculture:

- Increasing agricultural productivity through technological knowledge and innovation;

³⁸ COM (2010) 2020 of 3.3.2010

- Maintaining the agricultural production capacity throughout the whole ED by improving its competitiveness;
- Fostering green growth through innovation, thereby ensuring the provision of public goods such as the sustainable management of natural resources through agriculture;
- Contributing to the social, economic and environmental vitality of rural areas, which remains closely linked to the presence of a competitive and dynamic farming sector.

3. INNOVATION TODAY

Innovation in EU agriculture is today taking place in the following policy context:

- The decreasing importance of market intervention and the introduction of decoupled direct payments have made the sector more sensitive to market signals and more competitive. Farmers are bound to be more entrepreneurial and innovative due to increased consumer-orientation. Direct payments and a reasonable safety net have provided a framework for encouraging entrepreneurial risk-taking and innovation.
- Agriculture provides public goods and has a recognised social dimension. New societal challenges, such as climate change and sustainable management of natural resources, mean the agricultural sector can provide innovative public goods. These challenges also foster the innovative creation of recognised societal benefits, e.g. through agro-environmental measures.

A more detailed description of innovative processes ~ agriculture and rural areas today has been provided by the INSIGHT project³⁹. Innovation policies are very diverse across the EU. Moreover, geographical factors and agricultural structures, as well as the characteristics of the dominant production systems affect innovative performance. The institutional setting and, as a result, the innovation systems tend to be complex. Due to the cross-cutting nature of innovation in agriculture, they include several areas of competence and often belong to the domain of several ministries. In general, countries tend to grant more support to technological innovations than to social and organisational innovations. Important differences can also be observed regarding the priority given to innovation within national agricultural and rural development policies.

However, the analysis of such a multi-faceted concept as innovation in agriculture today is a broad and ongoing task. To this effect, building on existing research results and foresight exercises, a working group of the Standing Committee on Agricultural Research (SCAR)⁴⁰ began work in May 2010 on "Agriculture Knowledge and Innovation Systems" (AKIS) with a view to providing an analysis of the current status of knowledge and innovation systems in Member States, their trends and the driving forces behind the need for change. This group will report its findings to the Commission in 2011.

³⁹ Co-funded research project from the 6th EU Research Framework Programme. See <http://www.insightproject.net/>

⁴⁰ The SCAR was established by Regulation (EEC) No. 1728/74 of the Council of 27 June 1974 on the coordination of EU agricultural research. For more information, see http://ec.europa.eu/research/agriculture/scar/index_en.html

4. OBSTACLES TO INNOVATION

The INSIGHT project has pointed to a number of limitations in the current framing of innovation in rural areas. Institutional barriers represent an important obstacle to innovation. Knowledge and advice institutions have not yet adapted sufficiently to the change from product-related to direct payment support. Switching to demand-driven advisory systems requires different advisory processes. Procedures to acquire funds are complex, which makes access to funds difficult.

Discussing further these results and feeding in experience from Member States, the SCAR report on AKIS will also help identify commonly agreed obstacles and possible lines for improving innovation. For the present, the emerging perception is that other impediments to innovation in EU agriculture exist and are gaining in importance, such as:

- Issues are becoming more cross-cutting in nature. Innovation in agriculture is often cross-cutting in that it involves different sectors and interest groups. It is not only the result of the dissemination of new ideas or innovative products among farmers. All along the food chain, it involves actors from various fields, such as researchers, consumers, producers, environmental groups, rural communities and public services.
- Innovation increasingly requires networking approaches. The cross-cutting nature of the problems facing EU farming exposes the importance of networks of knowledge and sharing of experience. Networks are appropriate to the cross-cutting character of innovation in agriculture because they bring together all concerned actors (e.g. researchers, farmers and consumers).
- The "innovation gap" between the most and least advanced farms is wide. For example, in terms of formal training, around 80 % of EU-27 farms are managed by farmers who declare to have only practical experience of agriculture. This can impact not only on the profitability of individual farms but also on their relationship to the numerous other challenges that modern farming must face.
- Innovation has social dimensions. The contemporary conception of innovation includes alternative approaches, such as "social innovation", which seeks new answers to societal challenges affecting communities as a whole. This is appropriate for rural areas, which face specific problems, such as climate change, migration and restructuring. Furthermore, innovation today is expected to take into account issues of ethics and sustainability. Social acceptance of innovative solutions is a prerequisite. Beyond general material benefits, innovation is increasingly required to meet criteria of moral, environmental or social sustainability.

5. DEMOGRAPHIC STRUCTURE OF THE SECTOR

The CAP offers a wide range of possibilities to any farmer who seeks innovative solutions to develop his or her business, such as support measures to create and develop business and training and information. A non-exhaustive list of current rural development measures in Council Regulation (EC) No 1698/2005⁴¹, relevant to innovation, is found in Annex. In this

⁴¹ OJ L 277 of 21.10.2005 See <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:277:0001:0040:EN:PDF>

context, the uptake of advice and innovative ideas depends on numerous factors, of which age is not necessarily the most decisive one.

However, the EU's rural development policy, gives special attention to the situation of young farmers taking into account their positive input in the future of EU agriculture. Several measures are tailored to the needs of young farmers. Thanks to the flexibility in the design, targeting and implementation of rural development measures Member States can tailor their programmes to the requirements of young farmers at local level. Specific treatment for young farmers is provided through the following measures:

- Setting up of young farmers. This measure facilitates both their initial establishment and the structural adjustment of their holdings after their initial setting up.
- Modernisation of agricultural holdings. Support for modernisation of agricultural holdings is granted for investments which improve the overall performance of the agricultural holding. For young farmers, the aid intensity rate for farm modernisation is 10% higher than for other farmers.

Moreover, Member States can give young farmers special preference via selection criteria for certain measures which include:

- Support for "Vocational training and information actions" and the use of "Advisory services" aims to help young farmers face new challenges and improve the overall performance of their holding
- In order to foster innovation, the measure "Cooperation for development of new products, processes and technologies in the agriculture and food sector" is also available, promotes cooperation between primary producers in agriculture. The processing industry and/or third parties
- The measures "Diversification", "Basic services for the economy and the rural population", as well as "Support for the creation and development of micro-enterprises" can be important tools for young farmers as support aims at creating or maintaining an appropriate living environment in rural areas with a view to promoting entrepreneurship and developing the economic fabric.

6. FUTURE CHALLENGES DRIVING INNOVATION FORWARD

The Europe 2020 Strategy has identified a range of pressing challenges (growth, employment, climate change, ageing population, livelihood of rural areas etc.): which it seeks to address through its Europe 2020 Strategy. The CAP will make an important contribution to the new strategy, notably for "Sustainable growth" (e.g. ensuring a sustainable land management) and for "Inclusive growth" (e.g. unlocking potential in rural areas, accompanying the restructuring of agriculture) and "Smart growth" (e.g. increasing agricultural productivity).

From the point of view of the future of the EU agriculture, the challenges already identified in section 2 above can be broadly considered to be those driving innovation:

- Increasing agricultural productivity through technological knowledge and innovation;

- Maintaining the agricultural production capacity throughout the whole EU by improving its competitiveness;
- Fostering green growth through innovation, thereby ensuring the provision of public goods such as the sustainable management of natural resources through agriculture;
- Contributing to the social, economic and environmental vitality of rural areas, which remains closely linked to the presence of a competitive and dynamic farming sector.

The CAP addresses these shortcomings through a number of the measures listed in Annex as well as through the dissemination of research results using the newly created European Network for Rural Development (ENRD)⁴².

The Farm Advisory System (FAS), as laid down in Council Regulation (EC) No 731/2009⁴³, can also be seen as a channel for the promotion of innovative solutions. Under the terms of the CAP reform of 2003, EU Member States each had to set up a FAS by 2007 at the latest. The FAS covers the overall organisation and the various public and/or private operators that deliver farm advisory services to a farmer. Intended to help farmers become more aware of material flows and on-farm processes related to the environment, food safety and animal health and welfare, the FAS must address as a minimum the requirements under cross-compliance for direct payments. However, the field of advice is not limited to cross-compliance: Member States may choose to widen its field of advice to other issues. In half of the Member States this FAS advice already embraces broader issues, such as the competitiveness of the holdings, the environmental impact of farming practices and support for the implementation of rural development measures. The strength of farm advisory services is that they assess the specific situation of the farmer and provide for an advice applied at farm level. Such, advice is interlinking all different aspects of farming with a holistic approach. FAS advisors and FAS coordinating bodies play an important role in interactive sharing of the knowledge which is generated as well by farmers and by private firms as by basic and applied researchers. FAS coordinating bodies can create synergies between different instruments such as advice, training, information and research. Farmers use the FAS on a voluntary basis and rural development policy can be used to support the establishment and use of advisory services. The Commission is due to publish a report on the functioning of the FAS in November 2010, complemented with recommendations and proposals actions.

7. KNOWLEDGE AND INNOVATION SYSTEMS

Several key conclusions contributed to the creation of the SCAR working group on AKIs and led to the decision to analyse the link between innovation and knowledge systems.

In a first SCAR foresight exercise⁴⁴ there was a call for a review of the links between knowledge production and its use to foster innovation. The second exercise went further and stressed the need for renewed political attention to the effectiveness, relevance and scale of Europe's agricultural knowledge systems and for a redefinition of AKIS, arguing that

⁴² The ENRD contributes to the efficient implementation of Rural Development Programmes throughout the European Union (EU). Each Member State has established a National Rural Network (NRN) which brings together the organisations and administrations involved in rural development. At EU level, the ENRD ensures the networking of these national networks, organisations and administrations. For more information, see <http://enrd.ec.europa.eu/>

⁴³ OJ L30, p. 16 of 31.1.2009 See

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L2009:030:0016:0099:EN:PDF>

⁴⁴ See http://ec.europa.eu/research/agriculture/scar/foresight_en.htm

systems are *"currently unable to absorb and internalise the fundamental structural and systemic shifts that have occurred"* and are *"locked into old paradigms based on linear approaches and conventional assumptions."* A similar conclusion had been reached at a SCAR workshop in 2008, which identified a need for the old linear model of technology transfer (from scientists to the users) to be replaced by an interactive model of networking systems, integrating knowledge production, adaptation, advice and education.

The need to review current knowledge systems and their relation to the innovative process has thus been recognised. The outcomes of the SCAR working group are awaited before further evaluation of the role of a knowledge systems approach can be made.

8. RESEARCH AND DEVELOPMENT

Agriculture's main connection to Seventh Research Framework Programme (FP7) is through the "Food, agriculture and biotechnology" thematic priority, specifically devoted to the technological challenges facing European agriculture. It covers farm management policies, food safety and rural development with three main activities: sustainable production; fork-to-farm food; and life sciences, biotechnology and biochemistry for non-food products & processes. Arising out the 'Knowledge-based Bio-economy' (KBBE) theme, which united these activities, plans are being made in 2011 for a Communication and Action Plan on the "building the bio-economy by 2020", which issues relating to innovation in agriculture will be central.

However, with the evolution of cross-cutting issues within research policy, agriculture finds a growing relationship to other programmes of FP7, notably: environment (and climate change); socio-economic sciences and humanities; energy; information and communication technologies; and nanotechnologies and new technologies.

In the context of developing the European Research Area, co-ordination of Member State agricultural research is primordial since around 95% of research spending is managed by Member States. The key co-ordination activities monitored by SCAR are:

- "Foresight" and "Horizon Scanning" exercises on agricultural issues, which provide a broader and longer-term outlook on the challenges facing the EU agricultural sector.
- Improved dissemination (communication) of results and innovation through analysis of AKIS relate directly to the Knowledge Society initiative
- A number of existing European Technology Platforms (ETPs) of multi-stakeholders in areas such as Food for Life, Forest-Based Sector, Plants for the Future, Global Animal Health, Farm Animal Breeding and Reproduction and Manufacture

Within the context of the development of the Innovation Union, which is a major initiative of the Europe 2020 Strategy, agriculture will need to relate to the newly conceived instrument of European Innovation Partnerships. Their objective is to tackle a societal challenge by strategically aligning expertise, resources and policies at EU and national levels in order to speed up research and create a favourable regulatory framework to reach a specific, pre-defined target. The European Commission is currently examining how the key research and innovation challenges facing agriculture might be addressed through this new mechanism.

9. EDUCATION AND SKILLS

The level of formal agricultural training in the EU farm sector presents a highly varied picture. In 2005 in what is now the EU-27, the percentage of farmers with a "basic or full agricultural training" ranged from 0.4 % in one Member State to 71.5 % in another. In the EU-27 as a whole, the percentage was 20.0 %. In other words, 80 % of EU farmers have acquired agricultural knowledge purely through informal channels.

While informal channels are often effective at transferring knowledge, many "untrained" farmers operate on a small scale and exercise an additional economic activity. This raises questions about whether the EU farm sector is as open to "new" ideas, technologies and techniques as it could be and therefore whether it is fulfilling its potential.

One of the main channels through which the CAP offers support related to education and skills is the EU's rural development policy. The relevant support is provided primarily through five pre-defined "measures" in the full list of measures set out in Council Regulation (EC) no. 1698/2005, namely:

- vocational training and information actions (within the farm and forestry sectors);
- use of advisory services (see section 6);
- setting up of management, farm relief and farm advisor services (see above for advisory services)
- training and information (related to general rural development outside farming and forestry);
- skills acquisition, animation and implementation (related to general rural development outside farming and forestry).

When applying the EU's rural development policy, Member States / regions choose which measures they will apply on their territory from the total menu; they are not obliged to apply any of those listed above, but many choose to do so.

In the context of reflections on a CAP for after 2013, the European Commission is re-examining its use of rural development policy to help raise levels of knowledge and professional skill in the farm and forestry sectors and in rural areas in general.

10. KNOWLEDGE TRANSFER

Support comes from existing Rural Development policy to foster knowledge transfer (KTI) and remain an important concept in relation to the future reorientation of the CAP, where the role of rural development policy in improving knowledge transfer could be considered, as well as the possibility to encourage the uptake of innovation through links to measures such as the Farm Advisory System.

How to strengthen the linkage between research and innovation and improve the dissemination/ uptake of agricultural research outcomes, in particular intensifying the

communication between researchers and farmers, are also key elements of the SCAR working group's study on AKIS.

Furthermore, in the context of the European Research Area initiative on Knowledge Transfer in 2010 a third KT stakeholders forum will take place and the Commission plans to launch a pilot KT promotion scheme in the area of Bio-economy, as part of the “building the bio-economy” Communication in 2011.

II. EU POLICIES

Summarising the policy references made above, the CAP can be seen framework for a promising development of innovation in EU agriculture:

- The reformed CAP, through liberalised markets, decoupled direct payments and rural development policy, fosters innovation in addressing societal challenges, such as food security, climate change, biodiversity and water management, where the agricultural sector can provide innovative public goods.
- The CAP is a front runner in the bottom-up approach to social innovation. The LEADER axis in rural development may serve as a prominent example. The recently formed Rural Development Network also supports the exchange of experience and best practice.
- Support for knowledge transfer, training and innovation of various kinds is readily available through a wide range of measures in the EU's Rural Development Policy.
- The essential links between the CAP and under EU research policy and programmes, which serve as a basis or developing innovation in the sector, have been set out in section 8.

Annex I Non-exhaustive list of current rural development measures relevant to innovation

Measure (with article no. from Council Regulation (EC) No 1698/2005)	Innovation-related application
<i>Measure 111 (article 21)</i> Vocational training, information operations	Knowledge is essential to innovation
<i>Measure 114 (article 24)</i> Use of advisory services	Knowledge transfer
<i>Measure 115 (article 25)</i> Setting up of management, relief and advisory services	Knowledge transfer
<i>Measure 121 (article 26)</i> Modernisation of agricultural holdings	Investment in new technologies
<i>Measure 123 (article 28)</i> Adding value to agricultural and forestry products	Investment in new technologies

<i>Measure 124 (article 29)</i> Co-operation for the development of new products, processes and technologies in the agriculture, food & forestry sectors	Development of new products, processes, technologies
<i>Measure 125 (article 30)</i> Infrastructure related to the development & adaptation of agriculture & forestry	Innovative approaches to practical challenges e.g. water management
<i>Measure 132 (article 32)</i> Participation of farmers in food quality schemes	Production/marketing of products with new qualities
<i>Measure 214 (article 39)</i> <i>Agri-environment payments</i>	Use of innovative techniques to meet environmental challenges
<i>Measure 311 (article 53)</i> Farm diversification	Innovative non-agricultural projects
<i>Measure 312 (article 54)</i> Support for business creation and development	Businesses offering new products/services
<i>Measure 313 (article 55)</i> Encouragement of tourism activities	Tourism services involving new ideas
<i>Measure 321 (article 56)</i> Basic services for the economy and the rural population	Innovative approaches to providing services (e.g. broadband connections, other ICT services, mobile social advice units)
<i>Measure 331 (article 58)</i> Training and information	(Knowledge is essential to innovation)
<i>Measure 41 (article 63)</i> Implementing local development strategies (Leader)	Innovative forms of organisation, governance and decision-making

Oral evidence, 2 March 2011, Q 510-540

Evidence Session No. 14. Heard in Public.

Members present

Lord Cameron of Dillington (Chairman)
The Earl of Arran
The Earl of Caithness
The Earl of Dundee
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witness

Mr Georg Häusler, [Head of Cabinet, DG Agriculture, European Commission].

Q491 The Chairman: Mr Häusler, thank you for coming to see us; it is very kind of you to give up your time. We are investigating the competitive position of European Union agriculture: its ability to accept innovation, how the innovation processes work, the money going into R&D, the connection between research and development and farmers, and so on. We have taken evidence in the UK is and are spending the day talking to representatives of various member states. Perhaps you would like to make some introductory remarks, having received our questions.

Mr Georg Häusler: I received your questions. I understand that a letter was sent late in 2010 and that you got an answer today or yesterday, signed by my commissioner and by Commissioner Geoghegan-Quinn. There are detailed answers in it to all your questions.

Q492 The Chairman: Thank you. I heard Commissioner Ciolos at the Oxford farming conference talking about the importance of making our agriculture competitive, particularly bearing in mind the future global issues of food shortages, population growth and so on. Perhaps the greatest potential for an increase in production comes from eastern Europe and the new member states. What potential do you see for increased productivity in the new member states, and how will we achieve that?

Mr Georg Häusler: It is good that you address the issue of new member states immediately. One difficulty that we face in the common agricultural policy is the different types of agriculture. You come from a member state that is probably the most advanced in many areas. Your agriculture is very modern. Northern Ireland and Scotland are perhaps different, and the south-west is a bit different, but by and large agriculture in the UK is very advanced. In the so-called old member states, some areas are similar to yours, but in countries such as

Portugal and Greece, some areas of Spain, Austria where I come from, the south of Germany—I could name many other countries—the agricultural sector needs a great deal of development to become efficient.

With new member states, the situation is again very heterogeneous. We have countries like Poland and—the country that my commissioner knows best—Romania, where there is a lot of small-scale farming and a lot of restructuring to be done. That is inevitable. However, in those two countries you will find probably the most efficient farms in Europe. The biggest farm in Europe—52,000 hectares—is in Romania. South of the Danube you find modern techniques, super equipment, very efficient production methods, great soil et cetera. So the situation is very unclear.

That is a challenge for policy. So what do we do? There is great emphasis—which with CAP reform will probably grow even greater—on increasing competitiveness. Where we enter debate is on the sort of competitiveness we are looking for. Yesterday I had a discussion with German farmers, who said: “We are competing in the world market”. They were from the north of Germany and ran very efficient farms. My answer was: “No, you are not”. With regard to Germany, the UK or any given country, we should not forget about direct payments. Some people argue that farmers have a huge advantage because they get direct payments. There is also substantial border protection still in many sensitive sectors, so they cannot pretend they are fully competitive in the world market.

However, if you make a political choice that the policy objective is to move towards a world-competitive agriculture, that would inevitably mean, at the end of the process, doing away with payments and any transfers of income, excluding investment aid. That is possible. It would not be the end of the world. We in Europe would not starve; I do not agree with the very pessimistic outlooks. However, European farming would still have one enormous competitive disadvantage compared with, say, Brazil and others, and that is [high] standards.

One sector that is close to competitiveness and receives very little direct aid is the poultry sector. You will all be familiar with the laying hen issue and the European legislation on cages. We have taken the ambitious decision to impose, for animal welfare reasons, a rule that laying hens need a certain space. This puts the industry in a very difficult position compared with, for example, its most important competitors, Brazil and Thailand. This is a difficulty that we will always face. I could give many examples. If we in Europe lived in an aid-free world, all farmers would face this enormous burden without having any direct compensation.

There is also a tendency, at least in Brussels, in the European Parliament and in civil society at large—and in the UK probably more than anywhere else—to increase animal welfare standards and make things even more difficult. We are going in a direction that is burdensome to farmers because of the element of cost.

On the subject of innovation, the issue of production techniques is also very sensitive. I would say that the microcosm of Brussels is an innovation-hostile environment.

Q493 The Chairman: That is down to politics. Scientists and Commission officials are looking to make agriculture more competitive, but politics presents the obstacles.

Mr Georg Häusler: Is it politics? Is it the chicken or the egg? There is enormous pressure from civil society not to use GMOs, cloning and all the techniques that are coming.

Q494 The Chairman: When we spoke to American scientists they said: “We have a lot of GMOs in America, but probably if our research and development had to go through a

political hoop and filter at the end of the process, we, too, would have difficulties with GM in the United States—but luckily we don't have that”.

Mr Georg Häusler: Having said that, it is good and necessary to have a filter, but it is a competitiveness issue for farmers. Yesterday we had a discussion about the big difficulties we are having in the protein sector. We produce hardly any protein. The figure given yesterday was that 20 million hectares in Argentina, Brazil and elsewhere are used to grow the soya beans and protein necessary for our animal production. We were told that you cannot even buy seed any more in Europe. Companies are not interested in Europe any more when it comes to protein, because it is all GMOs and we do not grow those crops. Farmers are left without a choice. Environmental groups are asking them to grow proteins, but they point to the relative cost of growing wheat and soya beans; there is an enormous difference.

Q495 The Chairman: Coming back to the new member states, how can we bring forward innovation, which will include farm structures as well as scientific and technical advances? How can we make their productivity greater?

Mr Georg Häusler: A great deal has already been done through rural development funds—investment aid in the second pillar. The new member states were immediately at the same level as old member states, or even at a higher level compared to some old member states. There has been an enormous investment programme that is still going on and will be enhanced in future. It involves the simple restructuring of farms, building new farms, building new installations, buying machinery, getting roads to the farms et cetera. Probably you would not classify this as innovation because it is bringing these countries up to the level of the old member states.

The big difficulty we face in old and new member states is the gap between research and the farm. There is no bridge between them. Our analysis shows a serious problem of farm-driven demand.

Q496 The Chairman: Is there a role for the EU in this?

Mr Georg Häusler: Yes. First, there is a historical reason. We used to have a research branch in the Common Agricultural Policy. This was reorganised some 10 years ago. We created a research D-G and have a commissioner who essentially runs this policy on his own. Over the years, the agriculture bit has steadily decreased. We work in close collaboration with Mrs Geoghegan-Quinn, who is extremely concerned by this development, because it is ongoing. The basic difficulty seems to be that scientists are doing science somewhere in the corner and farmers are asking for something, but the scientists do not know what the farmers want and the farmers do not know what science does. This is why we launched the European Innovation Partnership. There is a lot of information about this in the letter. It is a tool to help to bridge this gap.

There is another difficulty with advisory systems to farms. We have FAS—farm advisory systems—which work in some countries but not as well in others. This is for various reasons. Sometimes administration has turned it into a system that farmers do not trust or use. What we are trying to do this time is emphasise the role of the farm advisory systems, give them a clear job description of what they are supposed to do, and also open up the system to private business consultants. Farmers—perhaps not in the UK but in other member states—are very hesitant to use private consultants on their farms.

Q497 The Chairman: Will this be paid for by the state?

Mr Georg Häusler: Not necessarily. We are thinking about general flat-rate help to farmers to enable them to get advice. The amount would be relatively small. In the long run, advice should have its price and farmers should see it as an investment and pay for it. By just setting up a state system, we would end up with what we have already. In some member states we have chambers of agriculture that are semi-state bodies. Farmers do not always trust them and so the system does not work well.

The Chairman: So you hope the new system will be trans-European, involving new and old member states. That is interesting.

Q498 Baroness Howarth of Breckland: On the subject of the transition from innovation to the farm, we have heard a lot about the difficulty of focusing that targeting. You talked about poultry and animal welfare. Could you take a thematic look at the CAP to target the issue that is causing the problem? If we find ourselves at a disadvantage in the world market because of animal welfare, which is a political issue, could we target that issue better? The system of direct payments is a blunt instrument. We said in our letter of January 2011 that we were concerned about the way the Commission sees innovation only in Pillar 2, when clearly it could be very much in Pillar 1. Direct subsidies under Pillar 1 are a considerable obstacle to innovation. Should the drive for innovation affect the entirety of the support for the CAP and provide for agriculture as demanded by the Europe 2020 strategy?

Mr Georg Häusler: Perhaps I should say a word about the pillar structure. I am surprised even at this late stage that we have a lot of philosophical discussion in Brussels about the pillar structure. It is a bureaucratic system. Farmers do not care about it or know what it is. We care about it for financial and technical reasons. We have multiannual approaches and can keep budgets for five or seven years in one area but not in others. The pillar structure is something I will have to reflect on, to understand the philosophical concept behind it.

We do this in the second pillar because it is multiannual. It is a financing instrument that does not work in a 12-month period. The rule in our system is that what you have not spent in 12 months in Pillar 1 is lost and goes back to member states. That is why we do it in Pillar 2. So what is Pillar 1 doing for investment? We should not underestimate the fact that Pillar 1 gives a solid base for most of our European farmers. It gives them security, predictability and a planning period.

Q499 Baroness Howarth of Breckland: Does it lead to complacency?

Mr Georg Häusler: Probably that as well, to a certain extent. We all know that this year cereal farmers probably would not have needed all the money. However, if we did not have first pillar money, often farmers would not be able to invest anything. We want to set a framework in which the farmer will invest. We do not want to tell the farmer what to invest in and what to do. We should provide a framework in which the farmer feels sufficiently safe as a businessman and invests for the next 15 or 20 years, perhaps for even longer. This is the stable framework that we try to provide. We should not underestimate the importance of Pillar 1 in this context. It is only Pillar 1—the system of direct payments—that gives farmers this predictability.

Q500 Baroness Howarth of Breckland: Do you not think it has a direct influence on stifling innovation?

Mr Georg Häusler: No, I do not think so. It gives the farmer possibilities. You mentioned complacency. Perhaps you see the farmer as someone who is happy with what he has and does not want anything else because he gets his money from Brussels. However, the farmers

I know want to make a business and a better living, on a better farm with a better structure and better organisation. This is what drives farmers, not the feeling that Brussels gives them everything they need.

Having said this, I do not deny that, particularly this year in good cereal areas, farmers themselves are asking: “Why do I get all this money? I do not really need it”. That is for another discussion. In the coming reform—I am not talking about innovation—we plan to introduce new elements of conditionality into direct payment, because, to put it bluntly, we want to get something in exchange for our money. Farmers will get the direct payment only if they do what is good for the environment, climate change et cetera.

Q501 Baroness Howarth of Breckland: Can you separate that from what a farmer is doing generally to develop their business? How can you be sure that the direct payment is supporting the business, which is linked to innovation and greening, and not being used—as the chairman heard recently—to buy a TV from China, thereby supporting the Chinese economy?

The Chairman: The previous budget commissioner said it was all very well giving structural funds to the new member states, but that instead of changing their farm structure, farmers would just buy a television that they could not afford before. He said that it would achieve very little in eastern Europe in terms of innovation and development.

Mr Georg Häusler: Of course, I cannot prove that they will not buy a new car with the money they get from Brussels. However, by and large the importance of this money is that it gives them a “planification” period; the farmer knows that he is in a relatively stable environment in which it makes sense for him to invest. Again, the trigger for him to invest is set in Pillar 2 because we give him the incentive, namely money. We allow him to buy something or introduce a new climate-friendly technique and we pay him 50 per cent of his investment because we are interested in it. This is the Pillar 2 function. There would be no Pillar 2 and much less investment without Pillar 1. We need it as a base; that is our conviction. As evidence, we have the basic income figures for the agricultural sector in Europe, which are not terribly good. The average income in farming is 40 per cent of that in the rest of the economy, which is not good. People in a gloomy sector will not invest. If they do not believe in the sector—if they believe that things are going to end and that there is no future for agriculture—the last thing that they will do is to invest.

Q502 Baroness Howarth of Breckland: For food security, it is crucial that the sector has both direct payments and innovation. We have heard in our evidence that if the two do not drive forward together, given the structure provided by the EU, that causes difficulties, particularly in terms of competitiveness. You mentioned the diversity of small and large farms, and how smaller farms develop their competitiveness and innovate in structural terms by developing co-operatives and working together in groups. How can the EU help with some of those issues?

Mr Georg Häusler: My commissioner always distinguishes three elements of competitiveness. He says in Europe there is one type of competitiveness that we might call world market competitiveness. We have a large number of farms that are competitive and produce for the world market. The vast majority, the second layer, are producing in what we call the single market, staying inside the union. The third layer is composed mainly of smaller farms. They produce for a local market. We want to develop this more.

There is sometimes a misunderstanding that we want to keep small farms small. We understand the element of restructuring and the need for smaller farms to become bigger.

Having said this, there is a place for short-circuits: producing for a local area, local markets and villages. We want to enhance this in the reform. We want to set up financing and investment programmes for small farmers to regroup in small co-operatives, to get together and perhaps even develop a local label that will be protected only on a local level. We have one system of quality labelling that protects us all over Europe. Experience shows that many farmers are not interested in this. They are not interested in producing for Tesco. They want to produce for their local market, but they want some sort of protection. We need to address this with relatively simple policy measures to provide a perspective for this type of farming.

We talked about new member states. One-third of the population of Romania is involved in this type of farming. Many of those people will move out of the sector; we agree on that. However, we cannot have 9 million families in the new member states moving to cities where there are no jobs, as a result of restructuring and doing what you did in your country 100 or 150 years ago. This is not necessarily the way to proceed in the new member states. Having said this, we saw this in old member states. The heartland of Spain is completely depopulated because of policies that were run in the 1950s and 1960s. The solution then was that one farm would cover seven villages and all the other farms would disappear.

The Chairman: Now we come to some more detailed technical questions arising from your communication.

Q503 The Earl of Dundee: What should the role of the CAP be in promoting new ecological knowledge?

Mr Georg Häusler: Again, I am not saying that we should tell farmers to do this or that through the policy. We need to set a framework so that farmers find themselves in an environment where they feel free to use new technologies and to develop innovative projects. Of course, we have the second pillar of investment aid. What we plan to do in the reform is set higher incentives in the investment programmes for innovative projects. We have not taken a final decision, but we are going in the direction of saying, "If you make a really modern investment and do something really different and innovative, we will provide much higher aid intensity than our standard intervention". This, too, is going in the direction of everything that is related to the environment and climate change, because that is one of the big challenges for the agricultural sector. There is a lot of new technology on the market that farmers do not use yet, or do not use enough, for cost and other reasons. This is where we can intervene and help.

Q504 The Earl of Dundee: Still on the role of the CAP, does the current research framework programme sufficiently highlight the CAP's knowledge priorities?

Mr Georg Häusler: No, it does not. There is an agreement between the responsible commissioners that it does not. Nobody is to blame for that. The slow death of the agricultural part of the framework programmes started 10 years ago. The interface between the agricultural and research sectors did not work on any level, starting with us in Brussels and going down to the member states. This is something that we need to do. The Commissioner in charge of research is proposing a substantial increase in the agricultural part of the new framework programme.

Q505 The Earl of Dundee: To improve funding and to strengthen relevant research, should funding increasingly be taken away from the CAP budget and allocated instead to R&D?

Mr Georg Häusler: What answer do you expect from me?

The Earl of Dundee: I am sure it will be a very balanced one.

Mr Georg Häusler: When we talk about the budget, this is the big challenge to reform. We are all living in a difficult budgetary environment, which will continue. There will be big competition between the best horses in the stable, and we hope to be one of the better ones. This is what is at stake. You are right to say that the research is there, and there is a good narrative in Europe 2020. Energy and infrastructure are also bidding for structural funds. Agriculture must make sure it is there as well. It must not be seen as a sector of the past, like coal mining, which will gradually run out. We have to be extremely careful, and if we are not able to have a convincing project for the future—and we need to change a lot in the policy, particularly with regard to enhancing the competitiveness of the sector—we will lose the battle.

Q506 The Chairman: You hinted earlier that you wanted greater returns from Pillar one. You also talked about introducing an agricultural extension service and mentioned that the bridge was missing. Can this happen without some form of modulation of Pillar 1? Very few farmers, particularly small farmers, would pay for services around innovations that they do not know about. Even big farmers in the UK would find it hard to justify paying a membership fee to a research organisation. Therefore, without a compulsory subscription in the form of modulation, how will this happen?

Mr Georg Häusler: Are you saying we would not have enough money in the second pillar to finance it? I would not worry too much about that. The second pillar budget for the period is something like €80 billion. That is a lot of money. The issue is also about redirecting this money. If someone builds a new stable in Poland, that is fine because they do not have one. If a UK farmer applies to build a new stable, we would probably say that if he does not incorporate a new technique and do something modern and innovative, he will have to look for his financing somewhere else. We have to make choices. I understand the underlying concept that if you do something extra, you need more money.

Q507 The Earl of Dundee: Commissioner Ciolos has spoken about networking and the partnership between research and development institutions and farming organisations. What does he mean by that?

Mr Georg Häusler: We are not yet at the end of our internal discussions on this. We had a recent meeting with the agricultural and science faculties of a group of some 28 universities in the Danube area. It is a loose association of universities that do research together. There is absolutely no link between this and the farming sector. This can change relatively easily. We can set up innovation partnerships and networking tools that will enable them to come together, talk and do what the farming industry wants. The farming industry has made specific requests; it is waiting for this. These two worlds seem completely separate and it should be relatively easy to change this. Here again, we do not want to tell them what to do. They can each do whatever they want. They should get together and talk to each other. It should not be Brussels bureaucrats telling them to do this or that, because to an extent this is what we are doing in the framework programme and it does not work. We are paying for things that nobody needs.

Q508 The Earl of Dundee: So the resolve is there to adapt the framework programme in that way?

Mr Georg Häusler: Yes.

Q509 The Earl of Arran: Do you see ICT as having considerable scope for improving agriculture?

Mr Georg Häusler: Yes.

Q510 The Earl of Arran: How do you see the CAP taking that on board to further improve agriculture?

Mr Georg Häusler: In the last two years, we have run a programme to bring broadband internet access to rural areas. It is a €1 billion project that is working well and the results are positive. There is basic investment to be made. As you know, securing access to ICT for farmers in remote rural areas is very difficult. This is already a reality for most farmers. Many already use computer technology. They use satellites for spraying their fertilisers and so on. This is the way forward. We will put a high incentive in the second pillar for this type of investment.

Q511 The Earl of Arran: Again, it is a question of transferring knowledge to the farmer and getting him to understand how it works.

Mr Georg Häusler: Again, the situation is very diverse. In some countries, nearly 100 per cent of farmers are on the net. They make their aid applications and everything related to them on computers. In other countries, the percentage is zero. This is where we will put our emphasis.

Q512 The Earl of Caithness: You talked about the uptake of research. My heart sank when you mentioned that the EIP will be involved. It is another initiative from Brussels, centrally organised. In a more recent answer you modified that, which encouraged me. Surely this is up to each country. We had a very good system called ADAS, which was an excellent way of getting research from the primary source to the farmers. Sadly, that was abolished and we have a missing link. Given that under CAP you have farm advisory systems for cross-compliance, how do you see the system working at the moment, how should it work in future, and should it be expanded from simply cross-compliance?

Mr Georg Häusler: Our present reflection is driven very much by our analysis of how the farm advisory system works or does not work in various member states. To some extent cross-compliance is a trigger for knowledge transfer. There is an obligation for farmers to learn about it, and the farm advisory system plays a role there. However, it is seen too much as a police force. It is not something positive that farmers see as a support. Rather, it is seen as an organisation telling them how to do things. We need to change this. It is extremely important that any type of advisory system is seen by farmers as something that helps them to do things better, to make better decisions and better investments. What you said is very important to us as well. We will not tell member states how to set this up; we will only provide a framework in which they can set it up.

In some countries, chambers of agriculture traditionally work extremely well. In some areas of France they work very well. Everyone is happy with the system and the results are good. Why would we tell them to do away with the chambers? In my home country, chambers do not work. They are seen as part of the administration. Farmers do not use their advice. We need to give access to private consultants and break up the public domain where everything is decided by the state and is seen by the farmers as part of the Government, or Brussels, or whatever negative idea they may have about it. In those countries where the system does not work, the idea is to provide a framework for setting up systems that actually work. We

believe generally that private consultancy is probably the best way forward. Having said this, there are exceptions where the system can work without that.

Q513 The Earl of Caithness: We have heard evidence from Denmark, where there is a small percentage of state funding and most of the funding comes from a levy on the farmers. Is that the sort of system you would recommend?

Mr Georg Häusler: No. Financing is a choice for member states. If they want to use rural development funding for that type of expenditure, that is a choice for them to make. They could also say that farmers have a strong co-responsibility and will mainly have to pay for it. The Danish system is different, because the farmers do not pay for it; it is a tax. Farmers have to pay the tax and do not have a choice. It is a levy. It sounds modern but it is not. If you levy a tax and finance something, it does not make any difference whether it is funded publicly or in that way. The farmer needs to see added value. If the farmer does not see added value, he will not pay—but if he does, he will.

Q514 Baroness Parminter: Our committee agrees with you that the issue of the division between Pillar 1 and Pillar 2 is less important than ensuring that all the money achieves the strategic objectives of CAP in future. Is there a shared agreement in the Commission about the strategic objectives for the future of CAP?

Mr Georg Häusler: We adopted the communication on the future of the CAP in November. That was a college decision and, as you know, our college decisions tend to be unanimous. It was heavily debated; a lot of changes were made to the paper at the last moment. However, the paper adopted in November, which is at your disposal, is the position of the European Commission and is shared by all members. It is also clear that inside the European Commission there are different tendencies. We have a broad spectrum of political families in the college. We have a very strong liberal family. It will be no surprise to you that the liberal family has a different approach from the conservative family. Even inside the different political families, people who come from more liberal countries—Sweden, Denmark, the Netherlands—take a more liberal approach irrespective of their political family. There is no unanimous position, for example, on whether there should be direct payments in future. However, there is a large majority in the college. The detail has yet to be seen. I am not expecting Commissioner Ciolos to make a proposal that will go through without any difficulties. There will be a lot of interventions and many members of the Commission will have a different opinion.

Q515 Baroness Parminter: On the issue of food policy, we in the UK have just had a big recent report on food, ensuring that we deal with food security issues both in the UK and abroad. To what extent should each member state have its own food policy strategy?

Mr Georg Häusler: I hope that we do not need that. If each member state has its own food strategy, we have completely failed. Many might question whether there is any value added in the European Union, but here there is. We have to develop a strategy; we do not have it yet. We have launched an initiative, with Commissioners Barnier and Tajani, on raw materials and commodities, which is a wider issue. There will be a separate discussion on agricultural commodities in the context of the G20, but there is a clear instruction that in a few months we will have to develop a strategy. What is happening in the world market, and what is happening with policy in the southern Mediterranean and elsewhere, means that we cannot rest and say there is nothing to be done.

This is a sensitive issue worldwide. We need a governance structure worldwide of the biggest stockholders in agricultural commodities. That does not mean we will create an OPEC cartel, as some have portrayed it. The idea is to come together on a regular basis to discuss issues like harvests, availability, droughts and whatever food crises there might be. If we do that together, it will give a good signal to the markets, which we want to continue to exist. This is a side issue; some believe we want to forbid the trading of commodities, and that agricultural goods should not be traded in the same way as other goods. Of course that is not our approach. We can have a more positive effect on what is happening on the agricultural markets if we administer our knowledge better.

Q516 The Chairman: Did you see the *Foresight Report* that our Government produced recently about the problems with the global food situation, and how important it is that we address them? In D-G Research the proportion of money going into agriculture has been quite small in the past; you have already referred to that. Do you see the Commission and member states generally recognising that there will be a world food programme and that more emphasis needs to be placed on agriculture and food in terms of research money for the long-term?

Mr Georg Häusler: I would not deduce from that alone that we need more money for research in agriculture. We have been told that there is not a lot of demand for agricultural research. That is the reason why there is little spending. Spending has decreased because nobody has asked for the money. This is something to worry about. Here I come back to what I said at the beginning. A lot of very concerned industries are telling us that they are gradually losing interest in investing in any research in Europe because a lot of what they are doing cannot be used in Europe. Research follows industry rather than the other way round. The real concern is the gradual decrease of interest in spending any money—both public and private—on research in agriculture.

Q517 The Chairman: I am not saying that you are not a politician, but do you think that politicians generally are becoming more aware of all the restrictions that we have on pesticides, GMOs et cetera? Is this going to change?

Mr Georg Häusler: I feel that it is going to change, but not necessarily for the better. If you follow the discussions of the institutions on any given subject related to food, they are going in the opposite direction. It is becoming ever more difficult. The economic side is not present in the debate; that is the problem.

The Chairman: The forecast for the next 10 years is that our agricultural development will be almost as low as that of Africa, compared with the United States, Brazil and so on.

Q518 The Earl of Caithness: Do you see any chance of that changing? I understand why research was not taken up. Under the old CAP, before the reform, we had surpluses and there was no need for farmers to do anything; they just kept on churning out milk and butter and got the same amount of money. Will the renewed emphasis on young people coming into farming—in the past 18 months there has been a distinct change in Ireland and the UK, with the message that there is now a future in farming—help to change the research programme? Surely there is an argument for moving more into Pillar 1 than Pillar 2, where member states have to pay 50 per cent of the cost, which in the current economic climate will be very difficult for a lot of member states.

Mr Georg Häusler: As you say, the new generation coming into the sector is clearly giving a big boost; we can see that everywhere. However, we have a problem with young people

entering the sector. You say the situation is better in Ireland and the UK, but that is not necessarily for a good reason. It is because the rest of the economy is in a very difficult state that people in Ireland are staying in farming or going back to it. It is a dangerous climate for us, because we have no interest in the rest of the economy not recovering, because that would close off a way out of agriculture. This is one of the big difficulties with innovation and the development of the sector in countries such as Greece and Italy. There is no renovation of the generations. People stay until they are 85 and then give up the farm—and these people do not invest, they just die slowly.

Q519 Baroness Howarth of Breckland: I find what you are saying quite depressing. You used the word “dangerous”. It is clear that one of the biggest strategic questions for Europe and for the world is the production of enough food to feed the increasing population over the next 30 years, before we hit some sort of plateau. I do not have a clear picture of the strategic view that the EU and the Commission will take in order to drive these issues forward. I recognise that the variables are complex. I am a social scientist and understand demographic issues such as the variety in the size of farms and the differently ageing populations. The population of eastern Europe is very different in terms of youth from that of the western group. I do not get a picture in all those variables of the way in which the EU can drive some of this forward to take us out of danger and ensure that the EU as a whole understands that this might be the number one priority in future.

Mr Georg Häusler: It is good to listen to your words, because this is exactly what we are trying to convince people of. In every crisis, there is a chance, and now there is a chance for agriculture. The big debate that we will have in the coming months, in the college and later outside it, is about bringing agriculture and the agricultural economy back into the centre of political debate. It is not a debate about a specialist agricultural minister in a little corner discussing the price of milk, but a strategic debate about the future of the continent.

You raised the key question in the context of the rising world population. Millions of hectares are being lost to agriculture in the rest of the world—in China, Australia and the US—and probably even in Europe. Some of the big new emerging powers are buying millions of hectares of agricultural land in Africa and South America. We in Europe are sitting here saying, “Agriculture is the old economy”, in what I call an innovation-hostile environment. A lot of political groups are telling us to farm as we did in the 19th century, selling our tractors and doing it in the old way because it will be good for the environment.

You have set national targets for greenhouse gas emissions. I met Lord Turner two weeks ago. He told me about this impressive plan. I asked how we can do this in agriculture when we have to feed Europe and the world. This is the strategic debate. Does Europe say that it can provide food for 500 million rich Europeans and import what we do not have, or does it play a role in feeding 9 billion people, including 1 billion people in China and India who are starting to eat meat? Everything is changing. Of course, the UK is becoming vegetarian, but that will not help.

The Chairman: I do not think that we are. The figure remains at about 3 per cent.

Mr Georg Häusler: I was told it was increasing.

Q520 The Chairman: No, not much. Does D-G Development come into your discussions? It will play a crucial part.

Mr Georg Häusler: Absolutely. We are also seriously considering setting up—with Commissioner Piebalgs, who is in charge—a development programme for Africa, as we did

for eastern European countries. We will not pay money, but will set up institutions to help technology to go there, and probably even give some investment.

Q521 Baroness Howarth of Breckland: We might learn from them in the end.

Mr Georg Häusler: There is huge potential for simple farming techniques. We in Europe are good at that and have people who can do it. With a little money, you can do a lot. Policy can play an important role there as well. Development is key to this, but unfortunately it is very difficult. There is an agricultural commissioner for the African Union, but because the institution is still young, it is very difficult. You also need to do this bilaterally with each country—there is no other way.

The Chairman: This is an interesting area in which I am closely involved. It is full of problems. Thank you very much; it has been a really good hour's debate and very useful for our discussions and reflections. We will produce a report by June that I hope will contribute to reform and to progress in EU agriculture generally.

Polish Agricultural Attache

Oral evidence, 2 March 2011, Q 541-564

Evidence Session No. 15.

Heard in Public.

Questions 541-564

Members present:

Lord Cameron of Dillington
The Earl of Arran
The Earl of Caithness
The Earl of Dundee
Baroness Howarth of Newport
Baroness Parminter

Examination of Witness

Mr Andrzej Babuchowski, [Polish Agricultural Attaché].

Q522 The Chairman: Thank you very much for giving up your time to come and see us. I hope you have not had too much work to do in advance. Your weekend was relaxed, I hope.

Mr Andrzej Babuchowski: Yes, definitely.

The Chairman: I am glad about that. We are doing this inquiry, as you gather, into innovation in European Union agriculture, and we want to find out how things work in different countries. We have a recording here, and we will be taking a note of what we say. In due course, you will be sent a transcript, and if you wish to correct anything, you must feel free to do so.

We are very interested in how research and development and the agriculture advisory services work in Poland. I wonder whether you can give us some sort of general overview of the way the system works in Poland. Perhaps we could start there, if that is okay.

Mr Andrzej Babuchowski: Thank you very much. I am very glad that I can share with you my experience and knowledge in this area. I am also very glad to hear that there is a country that really wants to do something in innovation and development because so far, in most cases, there have been plenty of discussions and talks, but not very much has been done. This is very important in order to increase the competitiveness of European agriculture and the European food industry.

In Poland, we are very well aware of the importance of the advisory system. Our system was created at the beginning of the 20th century, so it is a few decades old. At present, the system is constructed in the following way. We have a central agriculture advisory system located in Brwinów, which is a very small town near Warsaw. It has three branches: in Kraków, for southern Poland; in Poznań, for western Poland; and in Radom for south and central Poland. Some of those centres, especially Radom, expand their activities into northern Poland. This centre with three branches is supervised by the Ministry of Agriculture and Rural Development. We have 16 regional centres in our regions—we call them voievodships. They also have branches which are the remains of the former administrative structure of Poland, which consisted of 49 voievodships. Now we have 16. There was one centre in each voievodship. The 49 voievodships have been consolidated into 16 bigger ones, but the centres are still in the most cities which were formerly capitals of the past voievodships, so now they are the branches of the new voievodship structure. Their main task is to work with farmers and provide them with advice and the different kinds of support they request. They also support another advisory organisation, which could be private or self-governing. That is the official structure. Then we also have an advisory system created by local self-governments, systems created by private consultants and companies and a system that incorporates the advisory system for forestry—most forests are state-owned, but there are still private ones. There is also the separate advisory system within the farmers' organisation. As you see, the system is rather big.

The Chairman: That is very comprehensive. Thank you very much.

Q523 Baroness Howarth of Breckland: We are really trying to get some sense of what really works in advisory systems. We have had advice from a number of different witnesses about systems that do or do not seem to work. What changes have taken place in Poland, in terms of the advisory system, since accession to the EU in 2004? If you have the balance between the private and the public sectors, what has changed in terms of advice provision since you came into the EU? Has there been any investigation or research into the impact of the advisory services and on productivity since 2004?

Mr Andrzej Babuchowski: After the accession of Poland to the European Union, the system was heavily reoriented. One of the tasks given to the state-owned or self-government advisory systems was to advise farmers how to comply with existing EU regulation and to teach them what they should do and how they should work. In many cases, they realised that what they were doing was exactly what the EU required, but in some cases, the difference was quite substantial, especially on cross-compliance, the storage of fertilisers and the use of some means of plant protection. That was one task.

The second task was to try to use the system to help farmers to apply for direct payments as well as for grants from rural development programmes. Farmers were not aware of how to apply. About 1.5 million farms could apply for direct payments, and 300,000 or 400,000 farms were potentially willing to apply for a grant from the rural development programme. There was a limited number of people who had proper knowledge, so teaching all the

farmers was very difficult and this task was given to the state advisory system. That was pre-accession, but then the farm advisory system was given the task of evaluating farmers' applications for grants and helping them to prepare them. That was at the beginning.

Now the system teaches farmers how they should comply with new requirements imposed from time to time by the Commission, how they should manage their production and organise their farms to comply with the regulations to be entitled to the payments and what opportunities they have with the existing tools in the Common Agricultural Policy. There is reorientation in this direction.

Q524 Baroness Howarth of Breckland: Is it mostly a state service?

Mr Andrzej Babuchowski: Yes. This is also in the information I have tabled. We have 4,856 advisors, of whom 4,630 are in state or public bodies and the others are private bodies. It is mostly state.

Q525 Baroness Howarth of Breckland: Is there much development? Is there much movement towards private advisory services in Poland?

Mr Andrzej Babuchowski: At the very beginning, we observed such movement, but everything is cost-dependent. In most cases, when the services are given by the state, they are free of charge or for a limited charge. Many of those are the duties or tasks of the state services. In the case of private services, farmers have to pay. Of course, within the rural development programme, there is a programme which entitles farmers to a grant of about €1,500 for advisory services, but I do not think that programme is doing very well. I do not have precise data about it, but I do not think it is doing very well. Farmers usually have advice from the state advisory service, but there is another source, which is from companies. They give advice, but it is very narrowly focused. For example, if they supply fertiliser or plant-protection methods, they teach farmers how to use them efficiently, but it is not such broad support. None of those services are teaching farmers how they could apply for or use European funds. They are technologically and technically oriented and concerned with equipment.

Q526 Baroness Howarth of Breckland: This is my last question. You said that much of the advice is about compliance with EU regulations and ensuring that grants can be obtained. Do you think that the advice has also helped productivity?

Mr Andrzej Babuchowski: Yes, because in many aspects, I refer especially to semi-subsistence farms, one of the goals of this programme was to increase productivity and to help farmers to decide whether they want to be more productive and earn money from production or to quit agriculture. They help farmers see their future path of development. The advisory services sit with farmers and try to evaluate what they could produce on their usually small piece land with unfertile soil to be productive either by going into another area, such as agrotourism, or by improving their soil to increase productivity. That was also one of the tasks they tried to do. How efficient it was, I do not know.

Q527 The Earl of Dundee: In your country as a whole—I know there are different parts—how well joined-up do you think research and development, advice to farmers and their consequent deployment on the ground of improved methods are?

Mr Andrzej Babuchowski: This is a basic question concerning agricultural policy and research in the area. In Poland, our ministry supervises 12 institutes, which is quite a

number. There were more, but they have been consolidated to make them bigger and more efficient. They are now quite big units. We also have nine state-owned universities with about 47 departments or faculties that deal with agriculture. That is plenty. We wanted to cut the number to three, but we still have nine. We also have 10 research institutes which are subordinate to the Polish Academy of Sciences which mostly do basic research in agriculture or biology.

Q528 The Earl of Dundee: So what is the difference between the 12 institutes and the 10 institutes?

Mr Andrzej Babuchowski: The 12 institutes that are subordinate to the Ministry of Agriculture mostly do applied research. For example, the institute of animal breeding in Kraków is involved in the development of new breeds of animals and in improving animal welfare through feeding et cetera. It is very practical. On the other hand, the institute that belongs to the Polish Academy of Sciences in Jabłonna near Warsaw, is more involved in basic science concerning the metabolism of animals. Animal diseases are studied by the veterinary institute. The institutes that belong to the Polish Academy of Sciences do very basic research at a molecular level. Those which belong to the Ministry are more applied. We also have 10 other institutes which work on agricultural issues but belong to different ministries, but they work on applied science. Altogether, there are 18,000 research workers, including those at the universities. Of them, 1,500 are professors and 4,000 are PhDs. As you see, the staff is rather extensive.

In the case of the institutes that are subordinate to the Ministry of Agriculture, their duty is to help farmers to use this knowledge, but in most cases that is done through the advisory services because scientists are not always the best people to transmit knowledge to farmers, but they do it as well. Thirty or 40 years ago, we had extension services at the universities because many of those agricultural universities had large amounts of lands, a few thousand hectares, and did experimental research, so their extension services went directly to the farmers. Now, those extension services almost do not exist at universities. Most of the training for the farmers is in different courses, in seminars et cetera. They also take students working in the agriculture and food sector. That is their task.

It is also important that there is closer co-operation with industry. That is very important.

Q529 The Earl of Dundee: Although you explain that the level of connectedness between R&D and deployment on the ground in Poland is good, what changes would you nevertheless like to see to make it even better over the next year or so?

Mr Andrzej Babuchowski: My impression is that in Europe we have several programmes devoted to development, research and the dissemination of knowledge, but they are in different compartments. Some are framework programmes and others are within the rural development programme or the regional programme. It is very hard to see co-ordination at EU or country level to combine them. For example, in the rural development programme we have Articles 28, 29 and 30 that could be used to give money to investors, whether farmers or enterprises, to use knowledge generated somewhere else, in the institute or wherever, on the introduction of new technologies, the application of patents et cetera. It is very rarely used. This money could somehow be directed for the development of new technologies to help research institutions to work on something that is of interest to industry or farmers. These contacts are not strong, but should be much stronger.

Q530 The Earl of Dundee: That probably will not happen too quickly. Are you cautiously optimistic that it might? Is there the political resolve in the agriculture ministry in your country to move in the direction that you have just outlined?

Mr Andrzej Babuchowski: The Ministry is always trying to convince grant beneficiaries to use modern technology, but in most cases it is perhaps too early because of the level of technological advancement. Now, they prefer to buy new technology from the companies rather than develop their own solutions for some programmes. This money is supposed to be spent on new technology rather than to buy something new. It could also be used in different areas in technological, technical or managerial innovation. It is a very wide area, but the knowledge is not so well developed among the recipients of the grant.

Q531 The Earl of Arran: How far does innovation in Poland go? Is it just geared to agricultural productivity or does it go into rural development and helping households to run their situations in rural programmes? Is it just productivity in agriculture or does innovation go further than that?

Mr Andrzej Babuchowski: That is a good and very difficult question. After joining Europe, our productivity did not increase substantially. In many cases, agriculture is still extensive. Our farmers are preoccupied with the environment, which is very good, so they do not spend too much on fertilisers or plant protection using herbicides et cetera. This is one way. Farmers try to improve productivity, but the payments are not related to productivity. Recently, prices for agricultural commodities were low, so in many cases farmers had losses. If they increased production, they had bigger losses, so it was not an incentive to do so, except in order to improve animal welfare or better protection of the environment, which gave them some more money.

European funds did a lot for rural development. The appearance of villages and rural areas is changing. There are better roads, more infrastructure, more social life and more businesses are opening. In many areas, we used to have 15 or 16 farmers; now we have three or four in the village. However, the total number of farmers has not decreased very much because the money is paid to the owner of the land, not necessarily to the person who farms it. As an example, in my village in northern Poland, near Olsztyn, we now have only three farmers, but a few years ago we had seven or 10. I do not know how long they will last.

Q532 The Earl of Arran: Are they bigger farmers or has the land been abandoned?

Mr Andrzej Babuchowski: They are slightly bigger. Most other people went out of business and sold land to developers because my village is six kilometres from the city, so it is completely different. In other areas, the farms are bigger and people sold land to them, but in most cases they rent out the land because they can still get money from direct payments.

Q533 The Earl of Arran: How much importance is attached to training and education for farmers, particularly young farmers?

Mr Andrzej Babuchowski: Several years ago, we were afraid that when the borders were opened other areas would offer better perspectives, such as ICT, and that people would switch to other areas, such as high tech or humanities, so we would not have many people in agriculture. It was not so. There are still people going to agricultural universities who still think that agriculture is a good business with a future. We have quite a substantial number of young educated farmers. The average level of education is increasing. That is very

positive. There are many more people in farming with a university background or who are educated at a medium school level.

The Earl of Arran: That is an encouraging picture. Thank you.

Mr Andrzej Babuchowski: We hope that it is encouraging.

Q534 The Earl of Caithness: I shall ask you a couple of general questions for my own edification. Who now owns the 25 per cent of land that was owned by the state under the old regime? I come from an area of Scotland where there are lots of small farmers, and many of them have other jobs. Is that the same in Poland or is there a dearth of other jobs for them? Can they be farmers and do other work?

Mr Andrzej Babuchowski: The answer to the first question about the 25 per cent is simple and complicated. It is simple in that this land is now in the possession of the governmental Agricultural Property Agency which is supposed to sell it to farmers who want to buy it for agricultural production. I do not know the exact number, but there is still 2,1 million hectares in the possession of the agency. The agency is trying to sell all this land within two or three years. However, to a great extent this land is not idle because it is rented. It is used by farmers. The problem is that this land is concentrated in northern and western Poland as a result of history. After the Second World War, when Poland received the territory that belonged to the Germans before the war, most of the land became state-owned farms. However, part of the land was given to immigrants from what was eastern Poland, which is at present Lithuania, Belarus and Ukraine. They received land in the west and north for the land they left in the east. The remaining land was given to the state farms. Only a little of the land in central Poland was nationalised, mostly farms that were owned by noblemen. So in central and eastern Poland, there is quite a high population density and the land from only a few state farms could be sold to the farmers. In fact, there is almost no state owned land for sale. There is a quite a substantial amount of state-owned land in northern and western Poland, but those areas are sparsely populated. Therefore, demand for agricultural land is greater in central, southern and eastern Poland and less in northern and western Poland. People who want to build a new farm buy land in northern and western Poland, but those farmers who are doing very well in central Poland want to buy land that is adjacent or close to their farm because it is not a good idea to have agricultural land 200 kilometres away. This is one of the reasons why most of this land is still in the possession of the agency. In addition, access to some of this land is rather difficult. When it was owned by state farms, cost was less important. Political priorities forced them to use that land, and financial resources were completely different. This land is now being slowly sold to farmers who want to buy it, but the problem is also the cost of the land. The average price for agricultural land is now close to €4,000.

Q535 The Earl of Dundee: That is the 25 per cent. It is a remarkable achievement that in your country, 75 per cent was in private ownership, despite communist rule.

Mr Andrzej Babuchowski: More than 75 per cent was in private ownership.

Q536 The Earl of Dundee: That is wonderful. It is amazing to achieve that under the oppression of the communists. In regard to the proportion as it was in 1990, are the owners more or less the same?

Mr Andrzej Babuchowski: Last year, we had a national register of agriculture. The results will be known in a year's time, and we will know what change has happened. However, the

changes are not very big. People still like to have land, even the smallest piece of land. It looks like the average size of farms will increase.

Q537 The Chairman: Can we stick to the innovation agenda?

Mr Andrzej Babuchowski: The average size of arable farms has increased from six to 10 hectares, which is quite substantial, but there are many other plots of land that are very small or are not entitled to direct payments.

Q538 The Earl of Caithness: You have answered most of the question I was going to ask you about the farm advisory system. Your needs are very different from those of farmers in the UK so far as the farm advisory system is concerned, but given the reforms coming up in the CAP, do you see your farm advisory system going on to more of a charging basis, although it is a state-owned business, rather than being provided free as at the moment?

Mr Andrzej Babuchowski: My impression is that we will still maintain a state-owned advisory system either free of charge or making very limited charges. There is a problem with the advisory system because different charges are imposed on the system of advice, such as VAT and other additional charges, which are not very helpful in developing the system. If they are suspended or abandoned, perhaps we will see the development of the private advisory system. So far, I guess that the state-owned system will prevail.

Q539 The Earl of Caithness: Is that what you are going to argue for when it comes to reform of the CAP?

Mr Andrzej Babuchowski: I do not know precisely what our policy will be in the area of the advisory system. We will definitely want to maintain the state advisory system as well.

Q540 The Chairman: Do you think that the CAP generally is helpful for the modernisation of farm structures and for innovation? For instance, do Pillar I area payments lead to complacency among farmers? Can they live easier and therefore make less effort to improve and innovate or it is the other way round? Does it give them the confidence to innovate? Which would you say?

Mr Andrzej Babuchowski: Farmers learn that in order to be competitive, they must innovate. The problem for them is sometimes about where the innovation lies. Some have very low productivity and should or could improve their farms somehow to be a little more competitive, cost-efficient, et cetera. This process is very slow because in most cases farmers are learning by example. If one farmer does something, the others will observe what happens and then the next farmer will follow. If the first is lucky, he has the biggest benefit, but this happens.

There is also a specific attitude among farmers. In many cases, they want to have something that is bigger than they really need. For example, if farmers have 10 or 20 hectares of land, it is not necessary for them to have all the equipment because it is used for just a few hours or days per annum, but they say, "If I have more, I will need this for longer". When you calculate the cost and depreciation of equipment, this influences the economy of the farm. Farmers start to rethink many things. In most cases, economic education is much needed, but that is not in the interests of those who sell equipment. They want to sell more of it, and they convince farmers that if they have something, they will do better. Economics are very important because farmers are open to innovation if it brings benefits to them.

Q541 The Chairman: In terms of the reform of the Common Agricultural Policy, which is getting under way now, what would be the best thing in terms of modernising Polish agriculture that you would like to see?

Mr Andrzej Babuchowski: We should concentrate on innovative, modern, willing-to-develop farmers and use money from the second pillar because bearing in mind the challenges that are in front of us in 2030 and 2050—bigger food production, the preservation of the environment, less carbon dioxide—we must modernise agriculture, but we must also develop productivity to produce more food. There is no doubt. So we have to concentrate on open-minded farmers who want to be innovative and modernise their farms. In our opinion, more money should be spent on the second pillar because it is mostly used by innovative farmers. They take money to invest, to develop themselves, to improve production et cetera. The second pillar should be used for this purpose. The first pillar should help farmers to protect their basic needs which are necessary to survive in less favourable years and give them some return on investments they make for production if there are low prices. This is the basic idea for the first pillar. Our concept is to emphasise the second pillar as pro-innovation.

The Chairman: That is very interesting. Thank you.

Q542 Baroness Howarth of Breckland: So you are really talking about targeted and focused funding from both pillars as well as the innovative Pillar 2. We heard evidence earlier today about the concern that unless there is a safety net for those countries where farming is at a more basic level and farms are smaller, the population will find itself moving too quickly into urban areas and we will have some sort of demographic challenge. From what you have described, you have seen your communities moving from farms. Are you concerned that it could mean that large communities have to move from the countryside as the farms grow?

Mr Andrzej Babuchowski: We have observed depopulation in some areas of Poland. People have started to move away from rural areas because the working conditions are difficult and produce yields are not high. This was one of the factors taken into account in our less developed area subsidies. If we properly structure the first pillar, we will pay for different activities, even those that are not productive, such as the preservation of the landscape or other high value areas. We will pay farmers for this under the first pillar. Then people might stay in those areas because they are rewarded for what they are doing. The product does not have a market value, so if we give farmers a multilayer payment, a basic payment of, say, €57 to maintain land in proper condition, then you have to pay additionally to those in less favourable areas. There are few factors, such as the soil quality, the humidity, the precipitation and the temperature, elevation over the sea level and slope of the terrain which influence productivity in LFA and those living in LFA should receive a little more to stay because production is more difficult. They could be given an additional payment for high natural values and then farmers could stay to do some farming, and the ecosystem could be preserved. What we are really afraid of is if everybody moves from the area, the ecosystem would be completely changed, which has been observed. This is not what we want. In this respect, the first pillar is indispensable for that. The payment must not be equal all over all country but be paid according to what is needed to preserve given areas. In this respect, we think we can keep some, but not all, people on the land.

Q543 Baroness Parminter: I would like to ask about the wider EU regulatory framework on delivering innovation. The EU has introduced a lot of protection measures

Mr Andrzej Babuchowski: That question is so difficult and so wide. It also touches on ethical issues. The answer will vary from country to country. The truth is that you cannot stop progress. You can slow it down, but you definitely cannot stop it. Even if there are some areas where people are ethically against results of the research, new developments indicate that research could be done in different ways that are ethically more acceptable. Research on cosmetics and pharmaceutical products used animals for allergy testing, but now we have tissue culture, in which you can do many of those things. The question is difficult because in our opinion some ethical constraints must remain. We cannot use animals' eyes to test sensitivity or whatever. We must find another way, because animal and human welfare and well-being must be preserved. The question is how we should deal with GMOs. We widely accept that GMOs made pharmaceutical products are okay for our health. If we produce different drugs, we do not bother. It is a little different if you want to produce food using GMOs. The most difficult question in this area is an environmental issue about when GMOs are released into the environment. It is very complicated question whether we could observe crossbreeding with other plants or GMOs have traits to preserve them in environment. Today, I read a paper from the US that it was found that some biological item, organism or active particle—possibly a prion or a virus—found in genetically modified corn, or another plant, I do not know, may cause loss of fertility in animals. This could potentially be dangerous for humans as well. This infectious material is developing in GMOs. When we discuss new technology, we always say it is okay because nothing has happened for 20 years. The problem in science is that you know if something happens when you can identify cause and effect. In many cases, we can correlate things after several years of exposure when the number of cases is so great that we can acknowledge that something what we observe is a result of something, but of what? Then we go to find the connection. We cannot identify something when we do not know what we are looking for. That is science. My opinion is that we should develop science and research, but we must be very careful about implementation. There must be much better evaluation. It is not necessary for it to be business driven. It must be science driven, but it is very difficult to know whether something is, or is not, science driven. Many cases are politically driven.

Q544 The Chairman: What is the mood in Poland about, say, GM? You obviously have your view, which you have just given us. Is the general mood cautious or against?

Mr Andrzej Babuchowski: I do not want to say it is against. There are two different issues. GM food and feed there is a lesser problem. The problem is if you want to plant GMOs in Poland. If there are plants that are hard to crossbreed, such as corn, perhaps the mood is a little more in favour, but on rapeseed, which could be crossbred, we are very much against. On GM food and feed products, we are a little more open, but on releasing GM products into the environment, we are very cautious. In fact, people are surprised to learn that they are drinking or eating products that are made by GM organisms, such as chymosin which is used in 95 per cent of cheese production. Beer and some other drinks are also made with GMOs, but the GMO is then separated. There is GMO soya and two-thirds of soya oil is made from GM plants, but everyone uses it. People are getting accustomed to this, but releasing GMOs into the environment is completely different.

The Chairman: Thank you very much Mr Babuchowski. It has been a very good evidence session. It has been very interesting to hear about Poland.

Q545 The Earl of Arran: I have one quick question. How much of your country is forested?

Mr Andrzej Babuchowski: About 28 per cent, and the majority is in the hands of the state.

The Earl of Arran: That is very interesting.

Mr Andrzej Babuchowski: The area is not very big.

The Chairman: More than twice as much as us.

DG Research and Innovation

Oral evidence, 2 March 2011, Q 565-581

Evidence Session No. 16. Heard in Public.

Members present

Lord Cameron of Dillington (Chairman)
The Earl of Arran
The Earl of Caithness
The Earl of Dundee
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witness

Patricia Reilly [Member of the Cabinet of Commissioner Máire Geoghegan-Quinn, Commissioner for Research Innovation and Science], Rudolph Strohmeier, [Deputy Director General of DG Research and Innovation] and **Maive Rute**, [Director of Directorate F, DG Research and Innovation].

Q546 The Chairman: Thank you very much for coming in and giving up your time. This is a formal evidence session which is being recorded. We will be putting your words into writing and we will send you the transcript before it goes public. If you want to alter it in any way, you can do. We are looking at innovation in agriculture. We think that, with world problems, agriculture and food production will become increasingly important, and it will be important that European agriculture is competitive and productive. We are looking at the best way to ensure a modern agricultural system across Europe. You, I know, are setting up the EIP on agriculture. I don't know whether you want to make any introductory remarks, but in an ideal world it would be good to hear about the European Innovation Partnership (EIP), how it is going, where it's got to, what hopes you have for it and so on.

Patricia Reilly: Right. If you don't mind, I'll just open and say thank you for the opportunity to come and talk to you all. It is very nice to meet you. You're absolutely right and I agree that agriculture has a very, very important role to play in Europe's future. There is no question about that. The Europe 2020 strategy that was published last March identified food security as one of the key areas that we have to be concerned about. Also there are healthy ageing concerns and environmental concerns about renewable resources. For anyone concerned, it is clear that agriculture has a role to play in every one of those grand challenges. On a practical basis, in terms of food supply, we all know that there's a 70% projected increase for food demand worldwide by 2050. So we're simply going to have to produce more with less. Clearly, there's a role for research and innovation in delivering that. There is also efficiency in the context of low emissions, increased production, maintaining standards of food safety. They are clearly important, too.

As you know, Europe 2020 established a number of flagships, one of which was the Innovation Union. I have brought along hard copies. Within the Innovation Union, as you rightly point out, one of the actions that we have established as necessary to deliver its goals are European Innovation Partnerships. We identified a number of areas in which we wish to establish partnerships. The first one is at the point of launching fairly soon. It is the pilot partnership in the area of healthy and active ageing. We have a very ambitious goal with the healthy ageing partnership. We intend to deliver two extra healthy life years to the average European citizen by 2020. It is a very ambitious goal and the way that the partnership has evolved will very much shape the evolution of the partnerships in the other areas that we have identified. Agriculture is one; smart cities is another. We will probably do something in renewable energy and there are a number of other areas that we are looking at. We have always had a good relationship with D-G Agri, and Maive's directorate works closely on a regular basis with it. We are in the process of developing the framework for the European partnership on agriculture.

Q547 The Chairman: Have you as yet got any projects in mind or are you just setting it up?

Patricia Reilly: We are not second-guessing. If I tell you what we are doing with the pilot on healthy ageing, perhaps that will help. What we have done for all of the partnerships—horizontally we have established what we call a crack team. So there's a team of people looking at what these partnerships are going to be. We don't want a new layer of bureaucracy or a new set of instruments. What we want to do is to make the very best of the instruments that we already have, while streamlining and simplifying them. That is obviously another part of Commissioner Geoghegan-Quinn's approach. She made it clear from the outset that she is keen to simplify the process for anyone availing of EU funding or taking part in EU projects.

This crack team has started by looking at the governance—how the partnerships will look. We want to keep them light in terms of bureaucracy. We want to have them very much demand-driven so that the projects that emerge from the work of the crack team and the high-level steering groups that will be established for each partnership will be driven by demand. In other words, we want to try to focus on what it is that the key stakeholders want. In this case, obviously, it is people like farmers and those involved in the agrifood and biotech industries. What are the gaps in their innovation process? Where in the chain are there blockages and how can we unblock those?

With the healthy ageing partnership, we have got to a point where we have established a set of guidelines. They are indicative guidelines for the steering board. We have almost agreed

on the setting up of the steering board. There will be around 27, 28 or maybe 30 members on the steering board. That will involve a number of members of Councils, so there will be Ministers. Clearly, the Commission isn't going to tell the Councils who to choose, but it will not be one for every member state by any stretch of the imagination. That would be far too top-heavy. There will probably be four Ministers from four different countries. We would anticipate that those Ministers will be people involved not only in the relevant areas of research and the portfolios—in this case, health, science research and probably ICT—but also people who already sit on some joint programming committees. There will already be a level of professional knowledge as well as political buy-in at that stage.

We will clearly be involving the Parliament as well. We will be involving stakeholders like, in the case of the healthy ageing partnership, people from the ICT industry, pharma and biotech, and NGOs such as patient groups, carers groups and medical practitioners—representative organisations at a very high level. And we want people at a very high level because we need the operation of delivery to work, we need to be able to identify the blockages and to deal with them, but we also need political buy-in. The ambition for this particular partnership—I would envisage the same being the case in other partnerships—is that we will not just be focusing on key projects. Clearly, there will be key projects and we are not going to second-guess what the high-level steering group will identify as high-priority projects. However, in addition, we need to address a lot of horizontal issues. In the area of health, there are a lot of horizontal blockages across the EU. I will give an example; the approval of new medical technologies for use in member states. The length of time it takes to approve a new medical technology can vary from a couple of months in one member state to a couple of years in another. There is a whole complicated morass of bureaucracy involved in getting those devices paid for by insurance companies. It is only if we have high level political buy-in to try to get rid of those blockages that we can make any progress. That is the reason that the steering group will comprise both political and industry people.

This is very much a testing ground. We are starting with the pilot and undoubtedly there will be mistakes. I am sure there will be. Even if there are no catastrophic mistakes, there will be ways that we can improve on it in the upcoming partnerships. I am involved in the healthy ageing one and clearly I will be involved in the agriculture one. Quite honestly, I'm glad that agriculture is going to benefit from the experience of the pilot, because we will probably end up with a more streamlined version.

In terms of where we are at with the healthy ageing one, a public consultation will start on that very soon—I am not sure whether it has been launched, but it should be any day now. The Competitiveness Council will be discussing it at its next meeting.

The Chairman: Thank you very much. That was a very comprehensive introduction. Lady Parminter, do you want to ask a question?

Q548 Baroness Parminter: Yes, you've touched on the Commissioner's speech in your example about the blockages in the medical technology area. She talked about dealing with the regulatory framework. How do you see the EIP action really tackling the regulatory burdens which might be seen as a blockage formation?

Patricia Reilly: It's a big question. Rudolf, would you like to contribute something on that?

Rudolf Strohmeier: There are different aspects. There is a regulatory obstacle seen by those doing the research. Here, under the leadership of Commissioner Geoghegan-Quinn, the Commission recently adopted a set of simplification measures—mainly three—which will certainly help the research community to participate easily in research programmes at a

European level. It is different from member state to member state because each member state would be interested to see that the money is well spent. That means some controls have to take place to ensure value for money. That would certainly help. On the other hand, an obstacle we have identified in the Innovation Union communication is the innovation chain. If you look at the research as a starting point up to the market uptake, you see that option for Europe. Of course, for the national companies to have a level playing field you need a large market. I am German, and even for my competitors it is difficult to understand that Germany is not big enough to compete in this nature.

So, to establish this, we see that also we have an internal market in some sectors where we have a certain, for example, industrial tradition and there we don't have this more innovative approach. We still have to create that and ICT is a very good example. Here we need to identify at an earlier stage than now potential obstacles. The idea is to facilitate this via innovation partnerships to allow member states also to make use of their public procurement money. That corresponds up to 17 per cent of the European GDP. We have seen in other areas that they use this as a teaching tool to stimulate innovation. We are not doing that at the moment, but to have this, we need to have a common playing field that might need standards or regulation. In that respect, as this is a very sensitive issue about subsidiarity et cetera, we need to create some kind of acceptance of some kind of a way for member states to defend while they are opening so-called national markets. For European competitors, we need examples of a clear societal advantage.

Patricia Reilly: A very good practical example of something that is under way at the moment is the European patent, which I am sure you are familiar with. That has been log-jammed for so many years now but it finally looks as though progress is being made and Parliament is likely to agree to the Commission's proposal. It is approved, more or less, with the exception of two member states which are not inclined to go along with the proposal at this point. But that is a very good example of a way to break down some of the barriers to innovation. In the first year of our mandate, we have spoken to hundreds, if not thousands, of stakeholders coming in, from SMEs to enormous multinational companies. One of the many things that have been identified as a blockage in the EU is the whole area of patenting. It costs so much more to patent a product or idea in the EU and defend your licences in the various member states. The difficulty is the different languages and legal systems, compared to China or the US, or somewhere where things are streamlined. That is the sort of thinking that we have in mind.

Q549 The Earl of Dundee: The Commissioner mentions bottlenecks that she suggests prevent ideas from reaching the market. What are these bottlenecks, and are they additional to the familiar restrictions of regulations and standards?

Maive Rute: I assume that you are talking about the bottlenecks in agriculture.

The Earl of Dundee: I wasn't; the Commissioner was.

Maive Rute: I thought you were talking about the agriculture side of it—as regards regulation, what is perhaps missing and what gets in the way of innovative ideas reaching the market. First, we have to look also at the innovative ideas themselves and the knowledge creation in agriculture. We have clearly seen the trend of reduced funding to agricultural research for a number of years. At a time of abundant food available in Europe, perhaps also the importance of food security has not been so much recognised. Let us talk about knowledge creation first. One issue has been that the budgets in the member states devoted to agricultural research have reduced. Secondly, we also look at the number of scientists in

agricultural research, and figures from about 20 member states show that the number has reduced over the years.

Furthermore, from knowledge creation one has to get this knowledge to the industry and the farmers, and this has to be taken up by those end-users. What we see there are some weaknesses in this chain. First, the farmer advisory services have also suffered from some reductions. Depending on the countries, you see a different picture, but the availability of such farming advice service services has become less. Also, we have seen from the knowledge transfer chain, if you wish, that the feedback from farmers to the researchers is not necessarily there. Let us say, if we think of setting the research agendas, one essential point is that the researchers would know what the farmers need. In both those ways, communication could be improved from farmers to the researchers, as well as reinforcing the whole knowledge transfer and schemes which help new ideas and technologies to reach the farmers.

Evidence showing more is needed is that the recent trend of the increase in the yields has plateaued out. For a number of years, the increase in agricultural productivity has been at the same pace as the increase in population. In recent years, the increase in agricultural yields has slowed down and, depending on the crop, has reached a plateau. The technologies that are sometimes developed today at laboratory level or in the best universities are not necessarily reaching the users.

There is one more aspect, not a regulatory one; namely, the question of societal concerns about some of the most cutting-edge technologies. There, we should not underestimate the importance of having informed discussions and debates, and engaging with society, when we talk about some cutting-edge technologies in food systems and agriculture.

Q550 The Earl of Dundee: How far do you think the EIP might be involved in resolving such bottlenecks or any other difficulties?

Patricia Reilly: The plan is that it will be extremely focused, so it will not be a panacea that will solve every problem in research across the board. However, we will task the steering board with identifying a long list of priorities and then shortlisting those that will make the biggest difference, and do the most we possibly can to unblock the innovation chain. That is not to say that the EIPs are the only element of innovation within the next framework programme or financial perspective. I would be wrong to say that the entire research budget will be oriented towards innovation, but a large part of research policy will be. So without neglecting fundamental and basic research, which is clearly essential, we will be looking at demand-driven and results-driven research as being extremely important in terms of getting products on to the shelves and services available to people. The change in title of the Commissioner—Commissioner Geoghegan-Quinn is the first research, innovation and science commissioner—tells a tale in itself. We are putting innovation as being inextricably linked to research. It is not only attached to industry and new financial models, but it is closely attached to research.

Q551 The Earl of Dundee: By what date in the future do you think that the EIP might have had a chance to show what it's made of and to have produced a result?

Patricia Reilly: As I said about the pilot project, we have a very ambitious target to deliver these two healthy additional life years by 2020. When the steering board for the agriculture EIP has established what its priorities are and how it is going to deliver them, we would intend to have a target date of 2020. But that will not be the date upon which the whole thing is evaluated. There will be an evaluation process built into the timetable between the

setting up of the EIP and the final date. I would envisage, although it is not written anywhere, that the EIP will have quite a considerable legacy thereafter.

The short answer is that I cannot give you a date and time, but for sure we will have an incremental assessment and, if necessary, reorientation of the EIP.

Q552 The Earl of Arran: Still on the EIP, one is told that it is a stairway to heaven—cutting-edge research, technology, farms, businesses, library services. Is this really achievable?

Patricia Reilly: Yes, I think it is.

The Earl of Arran: That answers that question.

Q553 The Chairman: What about the bridge between farmers and agriculture? You mentioned agricultural extension, to some extent.

Maive Rute: Clearly, we are talking about the innovation partnership here, but we should not forget that the whole Common Agricultural Policy will have also a strong focus on innovation. Indeed, if you read the intentions, the CAP will try also to reinforce innovation within its policy framework. Then part of the rural development pillar in the CAP deals with the possibility of supporting farm advisory services. So I would imagine that part of the solution comes also from the CAP itself. Not everything needs to be solved—not everything depends only on the innovation partnership. The innovation partnership is really meant as an additional tool to focus efforts and to help accelerate the process of innovation in some key areas. But it is not going to be replacing the whole CAP, for example.

Q554 The Earl of Caithness: Let us develop that a little more if we can. Many of the blockages that you mentioned in answer to Lord Dundee's question were caused by EU policy in the first place. That is what caused all the problems. What else besides the EIP are you going to do in the short and medium term? Would you support the idea that innovation should be part of Pillar I in the CAP reform?

Maive Rute: Perhaps I first need to say I am sorry, but I disagree with your first statement. If I go back to the points I made about the research issues and some of the shortcomings today, clearly the European research area has helped to overcome of the difficulties. So I cannot agree that the shortcomings are the result of the Common Agricultural Policy. But if we look at what can be done earlier, and what is not necessarily waiting until the innovation partnership, in the CAP a stronger emphasis will be given to innovation. However, the policy is still being developed, so we are not in a position to say exactly what will be in there. But you will see the intentions in the Commission communication on this matter. Indeed, the intentions are clear that more innovation needs to be brought in, and also more of the concept of sustainability. So producing more with fewer resources will clearly be underpinning the CAP.

Patricia Reilly: And as to the structure of the CAP, I do not think it is for us to second-guess at this point.

The Earl of Caithness: I am not asking you to second-guess; I am just asking you whether you support it.

Patricia Reilly: Let's see what comes out of the current consultation process. I really am not going to second-guess what our agriculture Commissioner will suggest as the way forward.

Q555 The Chairman: Within the EIP, to some extent there is a huge amount of agricultural research in almost every member state. In Poland, there are an enormous number of research stations and agricultural extension services, all state-paid-for and so on. A cynic might ask whether we need this extra layer. Presumably one of your main roles is co-ordinating, pulling the research together.

Patricia Reilly: That is precisely right, yes.

Q556 The Chairman: That is so that everyone knows what's going on and can see where some of the gaps are.

Patricia Reilly: I think you have identified exactly one of the key issues. I lived in Poland for four years and was agricultural attaché to the Irish embassy there, so I am familiar with a lot of those substations all over Poland. Quite frankly, there are some wonderful scientists doing great work, but nobody knows what someone four miles down the road is doing.

The Chairman: Quite.

Patricia Reilly: And there are an awful lot of unread PhD theses and pieces of research work gathering dust on shelves all over Europe. That is a legacy of a fragmented research system across Europe. I am not picking on Poland in particular; it is just that I happen to know it quite well. But I know that that is the case to a greater or lesser extent in member states all over Europe. That is one of our main roles in terms of EU research. It is important to remember that while we have a very large budget at EU level for expenditure on research in agriculture and in every other area that we fund, it amounts to only 5% of the whole expenditure on research across the EU. The rest of the expenditure comes from the national purse and the private sector. As regards what we spend at EU level, we are very conscious of the necessity that there is an EU added value—that there is an added value for EU citizens' spending through this particular channel on projects that are funded by the Commission. Maive will be able to give you more detail on the mechanics of how these things work, with things like ERA-NETs—co-ordinating bodies where researchers are brought together to exchange ideas and information. In the pooling of data and the open availability of the results of research, we see we have a critical role to play, where national member states, with the best will in the world, do not have that drawing-together ability.

Maive Rute: Perhaps I may add something to that. One of the roles is a co-ordinating role. In a number of cases, we have found that the co-ordinating function at EU level helps to create stronger co-ordination within member states. Of course, the important thing for us is to ensure less duplication of effort and better co-operation to identify research priorities. That is one of the objectives. In the agriculture field, we see that member states have been keen to go further down this road. As you may know, joint programming initiatives have been proposed that reflect the need for stronger co-ordination between member states. I would not say that this is the only added value.

I will bring a couple more aspects to this discussion. If you look at what has happened over the years—Patricia hinted at this—the ongoing evaluation of the FP7 results shows that EU-level research has helped to raise the scientific level of research in a number of member states. Because of the competitive nature of science at the EU level, scientists who participate bring their new knowledge and networks back home and, by doing so, raise the standards of research in their countries. Furthermore, EU-level projects have helped to create cross-sectoral research communities in Europe. They have opened up national knowledge markets to research and ideas, and that will benefit all of us. It is a dynamic process that is better than having many separate researchers.

In a number of new member states, we also see that their research infrastructures are often outdated. By pooling resources and working together, they can use the available resources and infrastructures of other countries. This has become very evident in the area of animal health, where, by the nature of such research, if a particular disease does not exist in one member state, scientists there cannot research it. In the case of rare diseases, it is extremely helpful to work in co-operation on collaborative research, and then all of us will have much stronger outcomes. So we should not forget that the system adds more than a co-ordination function.

Patricia Reilly: Maive makes a good point. I will give one practical example. In a previous existence, I worked with the Irish Department of Agriculture and availed of a training course on classical swine fever in Germany, which was funded by the European Commission many years ago. It was at a research station in Germany. Had I not had access to that, it would have been very difficult to upskill on a disease that has the same sort of potentially enormous implications as foot and mouth disease.

Q557 Baroness Howarth of Breckland: It is very refreshing to hear you say that. The Green Paper acknowledged that many of the complex instruments in relation to research were overbureaucratic, and that the procedures lacked transparency. You talked about outdated infrastructures in member states. Perhaps there are outdated infrastructures within the Union. A number of our witnesses have described attempting to get into these funds as extremely difficult and incredibly bureaucratic, involving endless reporting and endless auditing, with no focus on science. However, the witnesses did welcome some of the new mechanisms such as ERA-NET and the European Research Council. In other fields, I have heard the same thing. How do you see the future, post-2013, particularly in research policy? How can innovation be encouraged through changing structures, and do you see any hope of doing that?

Patricia Reilly: Absolutely, yes. I see more than hope; I see a huge determination to change the structures. Perhaps you have seen transcripts of Commissioner Geoghegan-Quinn's first hearing with the Parliament before she was appointed. She focussed at length about simplification. She took a look at what happened and was frankly horrified by the layers of bureaucracy that one needed to go through to avail of framework programme funding, for example. It is unfair to suggest that this is just EU bureaucracy that has been put there to make people's lives difficult. It has evolved over a number of years. As with most bureaucracies, things get added but nothing gets taken away, so things get more and more complex. We are doing a root-and-branch examination of the instruments. We intend to simplify and rationalise where we can.

We have already started, with the simplification document, to try in the remains of framework programme 7 to unpick some of the really difficult problems. For the next phase, which will be post-2013, we are looking at a new landscape. The Green Paper is known as the *'From challenges to opportunities: towards a Common Strategic Framework for EU research and innovation funding'*. The public consultation on it is open and I would encourage anybody to take a look at it and contribute, and to alert anybody else who might want to contribute to it.

The idea of the common strategic framework is to simplify matters very significantly. We were very much aware that a large proportion of the budget goes to a relatively small number of recipients. We are very determined to change that. We have targets for the participation of small and medium-sized enterprises. The targets are ambitious and increasing. In some sectors, for example the medical research area, participation is already

quite good. In other areas it is not so good. We are particularly targeting SMEs with a view to making it easier for them to apply. We are very aware of the bureaucratic burden on people. Commissioner Geoghegan-Quinn is determined to put in place a simplified system that allows researchers to get out of the office and back to their labs, where they are most comfortable and productive.

Maive Rute: I would like to highlight one further aspect. I would not want to leave the impression that some of the funds go unused because the procedures are difficult. In fact, all our calls are oversubscribed. We receive about five times more requests than we can handle. Our budget is under great stress because we do not have sufficient resources to cover all the often high-quality proposals.

Q558 Baroness Howarth of Breckland: That does not excuse it. We heard from Poland this morning that they had had to use their extension fund to help their farmers to fill in the forms. All over Europe, I find people employing people to help them fill in the forms. Presumably that money could be better used if the system were simpler.

Patricia Reilly: I completely agree. Again, Poland is a very good example. You mentioned the ERC as something that is welcomed by a lot of researchers. That is absolutely true. It is the jewel in our crown, to some extent. It is a relatively young organisation. The criteria for choosing projects are based entirely on excellence. It is ridiculously oversubscribed. Poland has looked at the ERC and built a model of its own: its national criteria for allocating research funding are modelled on the ERC. We see an added value of our evaluation system, particularly the ERC, bringing up the level of standards and expectations of excellence, particularly in the new member states but in other member states as well. However, we fully accept the need for simplification.

Q559 Baroness Howarth of Breckland: We heard from Poland this morning. When you talk about partnerships across, would it not be useful if they could get funds from other sources, such as the ERDF, local rural development funds and other funds? Sometimes consolidated funds would make a bigger difference than bits of funds here and there. Is anyone looking across thematically rather than in compartments?

Rudolf Strohmeier: This is a very interesting question, which it is not new. In the past 25 years in these institutions, I have seen the issue coming like a wave every five or six years. From the purely administrative point of view, if one left things to member states and just gave them a cheque, that would be the easiest solution. On the other hand, the member states who pay in the end have never accepted this kind of exercise. They do not want to embarrass other member states, but want to justify to their constituencies that the money has been well spent. For that, they want some control, not necessarily exercised by themselves but by the Commission at a European level. That is the first element.

The second is that, particularly in the area of rural development, we give a lot of freedom to member states about what to do and how to do it, because we are controlling only the overall issues. Member states have a lot of flexibility within a commonly agreed framework. The problem that you have in mind is that of the individual farmer. There is a difference between those member states that have been familiar for a long time with these procedures, and the new member states that have to learn them. This is a matter of time. We are confident that for old member states it is just daily business. However, I accept that it can still be simplified and that there is a certain problem in getting familiar with the procedures.

There is something else that one should be aware of. The Commission, in the Green Paper—and the Commissioner herself has made this clear on many occasions—has

announced its intention to simplify procedures. For example, in the seventh framework programme you have the SIP programme. We have put this on the table as an idea in our Green Paper. Our intention is to cover most parts of the innovation chain, but also to apply the same procedures to all the parts. I am afraid that I can guarantee that some people and institutions will complain that the procedures that they are familiar with are being changed. There is a trade-off, but we are determined to take the risk in order to bring together the instruments and procedures. It makes no sense for them to be separate if we are going in this direction. I think that answers your concern.

Patricia Reilly: Perhaps I might add something. I am relatively new to the Commission, so I stand to be corrected, but I think that it differs from previous Commissions. When President Barroso assembled the Commissioners this time last year, he made it crystal clear that he wanted them all to work horizontally, to co-operate on their own dossiers, and to try to take a helicopter view of the societal challenges that we face, as opposed to everybody working in their own silos. With that in mind, we see great importance in the utilisation of things like structural funds, not just in new member states but in regions and so on, to improve research infrastructures and the dissemination of information that comes out of those research projects. We also see scope for demonstration projects on a reasonably large scale that will be very useful. It is something that we lack in Europe by comparison with the United States in certain areas such as new generations of alternative energy. If we get that right, it will really benefit from a European approach, rather than individual member states doing their own thing and going off in half a dozen different directions.

Q560 The Earl of Caithness: Following up on Baroness Howarth's point, we have also heard a lot of evidence that agriculture is particularly disadvantaged in comparison to health, for example, because it does not have big charities and companies. It is a much smaller and more diverse enterprise. Can you update us on the progress of the working group of the Standing Committee for Agricultural Research on the agricultural knowledge information system?

Maive Rute: Perhaps I am best placed to respond to that. A working group under the SCAR committee is looking at agricultural knowledge and innovation systems. The formation of the group was triggered by the recognition that we do not have enough of an overview of the existing farm advisory services or of the knowledge and innovation services. The group is still gathering evidence. It plans to report by the end of the year. This autumn the OECD is organising an event in Paris, so some sort of early report will be presented there—but the outcome is scheduled for the end of the year or perhaps early next year. The working group consists of representatives from the member states. They are collecting evidence, putting it together, analysing it and trying to come up with conclusions on the next steps. The interesting aspect is that SCAR is in the interface between science policy and agriculture policy. The people who represent their countries on the SCAR committee will be very well placed to take these recommendations back to their science or agriculture ministries. Hopefully that will help raise awareness of the need for reinforcing the extension services.

Q561 The Chairman: On the issue of global agricultural research, are you involved with EIAG, or is that D-G Development?

Maive Rute: We are involved. It is linked to development policy, but there is a strong research component, so we contribute to some research projects and are part of the management.

Q562 The Chairman: The impending food crisis is a global thing. A lot of food has to be produced regionally. In the UK, a lot of our research stations are linked to Africa and Brazil.

Patricia Reilly: We do a lot of work with so-called third countries outside the EU. We have collaborations with more than 120 countries on every portfolio that you could imagine. We have close professional contacts with the FAO, for example: you are absolutely right that it is important.

The Chairman: Thank you very much. That was very useful.

Dutch Government

Oral evidence, 2 March 2011, Q 582-604

Evidence Session No. 17. Heard in Public.

Members present

Lord Cameron of Dillington
The Earl of Arran
The Earl of Caithness
The Earl of Dundee
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witnesses

Mr Peter Keet, [Senior Policy Officer, Department of Knowledge and Innovation of the Dutch Ministry of Economic Affairs, Agriculture and Innovation (MEAAI)]. **Mr Krijn Poppe**, [Chief Scientific Officer, MEAAI, in the area of agriculture]. **Mr Frits Thissen**, [Agriculture Counsellor for the Netherlands].

Q563 The Chairman: Thank you for taking the time to come and talk to us. I gather that some of you have come over from The Hague for the occasion, for which we are very grateful. To put this into context, we believe that there will be a long-term problem of food production in the world—growing population, changing diets, water, all sorts of issues—and we believe that it is really important that European agriculture is innovative, competitive and productive as part of its role in solving these problems. So we are looking at innovation in agriculture across Europe. We have heard some very good things about the Dutch innovation approach, R&D, agricultural extension and so on, and we would like to hear more. So, again, thank you very much for coming. I should perhaps say that we are recording the interview. You will get the transcript and can alter it if you feel that something has slipped in by accident that should not be there.

I do not know whether you want to say anything by way of introduction, but the first thing we would like to know is about your agricultural knowledge information system—AKIS—in the Netherlands: how it has developed, why it is your priority, and how it works.

Krijn Poppe: It would probably be helpful if I gave a very small presentation as an introduction. I will pass this around.

The Chairman: Great. Thanks.

Krijn Poppe: I will take you through some of the general concepts we used when taking into account some of the questions that you formulated, and then we can probably have a very interesting discussion. I tend to call AKIS the Dutch Agricultural Innovation System (DAISY), just because it is a nice term. The graph on the first page gives you an idea of the value added to the Dutch agri-complex. So that is not only primary agriculture but goes from inland supply and the feed industry up to retail. It is nearly 10% of the economy. I have included it because, if you think about innovation, we very much stress innovation in the total chain and not just in primary agriculture. You could debate how much of the innovation is at farm level—historically we have had new techniques, like chemicals, pesticides and tractors—and to what extent it is coming from the food industry.

On the next page, on the food industry, we benchmark our R&D expenditure on food products, beverages and tobacco. The UK is not included in the figures, but I have listed the five countries shown here. These industries are compared with other industries. I always make the point that beer and coffee are rather old products, so in that sense you should not compare this with ICT, which in some European viewpoints goes wrong because of differences in the structure of the industries in the different countries. So I tend to compare the food industry, which excludes primary agriculture.

On your first question, on the Agricultural Knowledge Information Systems in the Netherlands, the first point is that we have highly educated farmers. That is dealt with in the diagram at the bottom. A high percentage, especially of the younger farmers, have a BA. That makes a big difference from the 1950s and 1960s when it comes to advisory services. I will take the diagram clockwise. In research, there is the well known Wageningen University and Research Centre, where we merged the university and applied research with experimental stations. They have still more outfits. The paper I have given you describes the background, the whole merger process and why it was merged with Wageningen University. It is a paper by Rudy Rabbinge. The other one is the University of Utrecht, which does veterinary science. And then we have an applied research institute which actually works with other industries, but that includes the food industry part. So that is the main research. And then there is the extension service, which is essentially privatised in the Netherlands. Fifteen or 20 years ago we privatised our extension service—the DLV. So extension is done by privatised consultancy companies, by agribusiness co-operatives which give their own advice to farmers, and more or less by farmers' own commercial accountants.

Q564 The Chairman: Do the farmers pay for it, or does the co-op pay for it?

Krijn Poppe: They pay for it.

The Chairman: The individual farmers pay?

Krijn Poppe: Agribusiness very often gives it free, certainly co-operatives. That is their competitive position vis-à-vis the investor-owned firms. So then you get it, but you pay for it through the pesticides, the tractors or the feed, especially the feed. It is the same for cattle breeding. In horticulture they pay a fee. They are even more advanced in that sense. So you pay the consultant per hour, so to speak, like you pay McKinsey.

Q565 The Chairman: A compulsory fee?

Krijn Poppe: No, you hire them. If it is commercial then you hire them. Accountants are paid per hour of advice. That is the business.

And then there are the agricultural schools, which are managed by the Ministry of Agriculture. But, as you probably know, we in the Netherlands merged that last autumn into the Ministry of Economic Affairs, Agriculture and Innovation, which is probably an interesting subject to discuss as such. It shows the business and agriculture, orientation in the Netherlands.

In this support system there are also several institutes that cater mainly for the needs of the Government in their policy support. Between these building blocks there are a number of network organisations and intermediate organisations which are part of the Ministry of Agriculture—to use that name for the moment—that try to link research, extension, education and innovation. There is the Innovation Network, which is part of the Ministry of Agriculture. It does experiments. Mr Keet has brought a paper on how they are organised. It is a rather inexpensive organisation which does out-of-the-box experiments in agriculture and foods. It also deals with what we call multifunctional agriculture—health on the farm, nature provision—and tries out experiments. We had a similar organisation, called Transforum, that also had this innovation-driving network.

Peter Keet: This innovation network is paid by the Ministry but it is positioned independently. So it has its own board and makes its own work programme, just to promote more radical ideas and new concepts. Our Minister, in the end, is probably responsible for it, but it can normally do what it wants. It is a network organisation. I brought with me a paper describing what it is doing. I think that the budget is about €4.5 million a year for programme costs and for the office. It has about eight or nine people.⁴⁵

Q566 Baroness Howarth of Breckland: Does the board also monitor how the experiments and the innovation get translated into practical application, and is there external monitoring of that?

Peter Keet: Thank you for the question. It is their aim to translate good ideas and new concepts into practice. They say: thinking *and* doing. So they are not flying high and telling other people what to do; they try to implement it themselves and they make a yearly report on their activities. Well, sometimes they fail, but we think that that is normal. If you never fail then you are taking too little risk in innovation. That is the idea.

Krijn Poppe: The risk lies also at the point where you stop and how it follows the first experiments.

Q567 The Chairman: Do they have farmers on the board, or only scientists?

Peter Keet: No, not only scientists; there are people from industry. I think that there are one or two representatives. The board 13, members, with one farmer, people from industry, medical research, and politics.

Krijn Poppe: In the same area we have network programmes in our applied research where farmers and researchers are brought together to work on what we call innovation-driven research. There is also a linking organisation between education and research which is called the Green Knowledge Co-operative. It is not a real co-operative, as such. It tries to improve the linkages between the research system and the agricultural schools by working

⁴⁵ NOTE BY WITNESS: The innovation network can be found via weblink <http://www.innovatienetwerk.org/en/>

jointly on programmes, partly educational, partly entrepreneurial, for young farmers—that type of activity.

As for the background to the Dutch system, it goes a long way back—to 1886. I will not take you back too far into history, but of course, at that time, we had the competitive problems with eastern Europe and the United States, because the cheap transport of cereals came in, and there were three typical reactions. You had a free-trade perspective in the UK, with the Commonwealth behind you, and you had just abolished the Corn Laws. The Germans and the French went more for protection from other regions. The Dutch had almost no industry. The heavy-metal industry was in the south of Belgium, which had just seceded 20 years earlier. So we and the Danish went for innovation. Innovation thinking is deeply rooted in the culture and attitudes of the Ministry and of business.

Q568 The Earl of Arran: Your innovation is deeply imbedded in horticulture as well, is it not?

Krijn Poppe: I am talking also about horticulture.

Q569 The Earl of Arran: How much of your land mass is given to horticulture as opposed to agriculture?

Krijn Poppe: The land mass is rather small, I think. It is concentrated between Rotterdam and The Hague and in the region of Venlo. I would have to look it up, but it is certainly less than 10%.

Q570 The Earl of Arran: A huge amount is given to horticulture, is it not?

Krijn Poppe: Yes, but less than 10% of the land mass.

Q571 The Earl of Arran: You would not know that from Dutch imports, but we won't go into that now.

Krijn Poppe: There is an enormous value added in horticulture, but it is only a small part of the land use. The big land use is in the north-east, and that is cattle farming and arable farming.

Peter Keet: If you want, we can provide the figures.

Krijn Poppe: I can send you the figures. They are easily available.

So the sector is capital-and knowledge-intensive. It is policy-intensive of course, perhaps more so than in other countries. A lot of sectors like horticulture are not heavily influenced by the Common Agricultural Policy, but they are influenced by environmental issues and all the public/consumer concerns. You might challenge this, of course, but we tend to see the Netherlands a little bit as innovation-led—with very demanding consumers, civil society having big demands, environmental problems and all the other production and export issues. Innovation is not just product invention; it happens in a social system. As for that social system, our current Government call it the Golden Green Triangle between government and business. Others have described it in the past as the Dutch agri-innovation KOMBI, with five types of parties: the knowledge institutes, the Government, NGOs, business and intermediates. There are a number of linking principles between these very different types of actors. They do not have to agree, and in fact they do disagree, of course. NGOs have certain issues where business totally disagrees. But due to principles such as openness, proximity and a number of connection mechanisms, there is at least strategic agenda-setting, and deals are made between those different parties. So there are new products which are

sponsored in retail terms for three or four years by the World Wildlife Fund or another NGO, for instance, as a product introduction, to make it a more sustainable product.

What does the Ministry do? We feel ourselves responsible for the system. As I said, the Government talk about the Golden Green Triangle between industry, knowledge, institutions and policy. It is probably also a little bit Dutch in terms of our consensus—what we call polder democracy. In the Ministry of Agriculture we also tend to have a very dense information system in the sense that the people working in the Ministry try to connect the social challenges and the competitiveness issues by making deals between government/public concerns and the concerns of the industry. Therefore we try every time to find the best policy instruments. Sometimes that is a regulation; sometimes a subsidy; sometimes an innovation programme. That is in essence the system. You see this also in the picture with all those arrows on the different types of research in the applied domain. So if you take the competitive position of the food industry and primary agriculture, then I think the main policy instruments are agricultural education; basic research, academia and universities—Wageningen, Utrecht and some of the top technological institutes, such as the food technology institution, or the one for genetics. Then there is, of course, the general innovation policy, which also holds for the food industry and for farming. It is to do with labour markets and that type of thing—fiscal instruments. And then the Ministry tries to link those policy instruments together, where essentially the food business or agriculture is responsible for new products and innovation. It is not the Ministry that runs innovation; it is the businesses that do innovation. We as a Ministry try to link the societal challenges and public concerns—sustainability, CO₂, you name it—to innovation programmes, where possible cofinanced by the Ministry and business, so that we have the same agenda. That involves deal-making between our Minister and business. It is a choice between the different policy instruments. Therefore, in our applied research at Wageningen we have different applied programmes. We have the so-called innovation programmes which do not directly benefit the Ministry, such as those for organic agriculture, certain diseases or challenges such as animal welfare. There are programmes that have much more to do with statutory monitoring tasks, on the nitrate directive et cetera. And then there is research for policy, which is probably no different than that for other countries. A certain amount of money is transferred to Wageningen to retain a certain knowledge base and research instruments.

In conclusion, before I turn to your questions, I am co-leading a group here in the European Union with the different ministries on *agricultural, knowledge and innovation systems*. The question is, do they exist or has the term just been invented by researchers? We think, at least in the Netherlands, that the agricultural knowledge and innovation system does exist. There is a social dimension to innovation in the sense of learning networks between different actors. The system is changing a lot. NGOs are now much more important in innovation processes than they were 10 years ago. Wageningen as an integrated research centre is a new construct. The innovation networks that Peter talked about, with connecting and linking organisations, are all from the past 10 to 15 years. Recently, the Ministry of Agriculture merged with Economic Affairs. An interesting point about the merger is that our Minister sees the Wageningen model and the Golden Green Triangle as an important example for other sectors. As a research guy, I am not sure whether that is based on evidence.

What makes agriculture different from the creative industries or from high-tech firms such as Philips and ASML is something that we still have to think about. In a number of those areas, at least in the Netherlands, there is a strong sector such as water, electronics or agriculture. These are clear examples where there is interaction and agenda-setting between government and industry. There is little polarisation. The ministries adopt regulations that

are either favourable or not favourable to the sector—things covering standard-setting and innovation programmes—that business then takes into account.

Q572 The Chairman: Thank you very much for that comprehensive review, which has probably already answered most of our questions. Perhaps I might ask a follow-up question about knowledge systems and agricultural extension. In our inquiry up to now, it has been the link between research and development and the farmers that has largely been the problem, certainly in England. We heard this morning that in Denmark, there is a compulsory levy on all farmers that pays for it. In Poland it is provided entirely free by the state. Where the system is voluntary, farmers occasionally ask for advice on soil structure or something like that, but a lot of farmers do not even know how they can improve and do not believe that they can improve. We used to have a government-led system in England, but it is gone now. Does it work in Holland? Do farmers pay for it? Do some farmers use the system while other farmers don't?

Krijn Poppe: We have compulsory levies by the commodity boards, but they are not directly used for advice or extension. They are used to fund certain research programmes such as breeding seeds—in glasshouse horticulture, for instance, to get glasshouses that provide energy instead of using it. These programmes are cofinanced.

There are many types of farmers. I'm talking about the professional ones linked with business. In the Netherlands, since the 1930s, they have been obliged by the tax system to have a bookkeeping system, which they pay for. They get accounts that include a benchmark between their results and those of other farmers. They speak to their most trusted adviser, who is their accountant. That gives them the background on where they are in comparison to one another. That is complemented by an investment officer from a bank. That is the system, with its problems and potential improvements. Based on their education and background, farmers operate in networks, come together in farmers' organisations and, if necessary, buy advice. When it comes to building advice, the old state advisory system that is now privatised has a large market share. Farmers go to their co-operative if they have feed problems, et cetera. They get the advice free or they pay for it. In horticulture, they pay.

Additionally, we have the Farm Advisory Service, which is required by the CAP for cross-compliance. It is significant that all three of us had to look up how it works in the Netherlands, because we didn't know.

The Chairman: We'd have to do the same in the UK.

Krijn Poppe: That shows something. It is not in the front of our minds in the Netherlands. We had a trial with vouchers.

Peter Keet: We have a system of innovation vouchers. What is interesting there is that farmers can get a subsidy for formulating research questions and going to researchers. If 10 farmers join the study, they will get a substantial amount and will go to applied research stations.

Q573 The Chairman: Who issues the vouchers?

Krijn Poppe: They are issued by the Government.

The Chairman: So if they combine, they get free advice. That is a good idea.

Peter Keet: There is one thing to add on that. Our ministry is also funding what we call *network organisations of farmers and researchers*. As Krijn said, our farmers are quite highly educated, so they can speak easily with researchers, unlike 100 years ago. We think that

those networks play a role in integrating the production and use of knowledge. Farmers have discussions with researchers, both on a practical and on a conceptual and theoretical level, and the researchers also learn from the farmers. We say that *research* is expensive but *networking* is not.

Q574 Baroness Howarth of Breckland: I'm trying to digest the vast amount of information that you have given us and relate it to where we are in the debate. You talked a bit about how the Dutch Government work with WUR, so we have a picture of that. However, it sounded as if you were talking about a highly integrated system. How did you get that very integrated system and what were the difficulties on the way? What needs are there for the further development of that system to ensure productivity? If you have these benchmarks, where do you stand in relation to international productivity? European productivity is very low compared to that in other parts of the world. Are the Dutch in a better position than many other parts of Europe?

Krijn Poppe: Those are different and difficult questions. On the forming of Wageningen UR, the process is not yet complete. I'm also not sure how integrated you can get with 3,000 or 6,000 people working in the same organisation—you still have islands et cetera. This goes back a long time. It started some time in the 1980s, when the ministry had a lot of applied research institutes and started bringing them under one umbrella. It also moved from input financing to output financing. That was probably influenced by the Reagan-Thatcher doctrine of the time, but I am not sure whether I am allowed to say that in this environment. The idea was to give clear incentives for the type of research that we needed. Then at a certain moment it was put outside government for the very practical reason that the number of civil servants had to be reduced and it was very attractive to count them in another way. That is how transitions happen; you see it in the literature. That was an important step in bringing applied research and the university together. There was a report by a former Mayor of Rotterdam, and former Cabinet Minister, who got a request from the Ministry to look at potential problems in the knowledge system. He came up with the advice to bring it under one management. Officially and legally speaking, there are two organisations—one is called DLO and the other is Wageningen University—but they market themselves as one organisation, they have one logo and they are under the same management, so the directors of both organisations are the same. However, formally one is a foundation and the other is a university. It was evaluated by an outside consultancy a few years ago. They came up with a favourable report saying that the objectives of integration and serving clients better had been achieved.

Q575 Baroness Howarth of Breckland: How does that show in productivity terms? Is the integration between research and innovation paying off at the farm level?

Krijn Poppe: I find productivity a difficult concept. I was at a conference a few years ago in Washington on this question. My report was published; I can send it to you. It is called a economic evaluation of Dutch agriculture. We have a very high level of productivity if you look at yields or value added per worker in primary agriculture. It is the highest in Europe. We are also one of the richest countries with some of the most fertile soil. I still work partly in Wageningen—I'm on both sides—but we cannot attribute our productivity only to knowledge. It is a multifactor thing.

The second point is that in the 1950s, 1960s and 1970s, a lot of government research went into lowering the private cost price of food by improving the productivity of the farmer. Over the past 20 years, a lot of the investment has gone into the public concerns of what we now call sustainability, environmental problems, biodiversity and animal welfare. We have

been trying to reduce the social cost price of our food. If you interviewed farmers, they would say that a lot of that research has created more problems for them to deal with, for example with animal welfare.

Q576 The Earl of Dundee: Perhaps you could say a word or two more about your current plans in the Netherlands for innovative food products, and how far such plans are part of a sustainable long-term food strategy.

Krijn Poppe: Here, the ministry plays the same type of role as with primary agriculture. We have put in a lot of money. It is debatable how sustainable organic farming is, because you need more land than for conventional farming. However, we have put a lot of research into organic farming. There are a lot of programmes on other types of sustainable farming and animal welfare. This is not just in the area of primary farming. A lot of the research is also to do with market introduction or even finding new types of retail opportunities such as farmers' markets in cities. We spent quite a lot of money 15 years ago to get organic food out of health food shops and into the main retail channel. We funded experiments to try to convince the milk industry that organic milk made sense and that there was heterogeneity in the market that it could use to attract more money to the sector.

We did the same recently with fish, where we have enormous sustainability problems. All these examples are demonstrations and first proofs. When it comes to other types of sustainability, companies like Unilever and Sara Lee are running sustainability programmes—much more than the Dutch Government can.

Peter Keet: On the issue of developing food products, the Government do not fund research for companies developing new food products; companies fund it themselves. Sustainability is one of the main issues now in our ministry. We fund a lot of research on that. For instance, we are funding research on the relation between food and health. We have huge obesity problems, as you have in the United Kingdom, so we are funding research into making food consumption patterns more sustainable. That is another main line of research funding in the Netherlands. We also fund food product-related basic research in a special programme at Wageningen.

One example of a knowledge-intensive product is cherry tomatoes. When you buy those small tomatoes in a shop, you do not see the huge knowledge behind them—knowledge about breeding, logistics, disease management, product development and marketing. A whole chain of innovative concepts lies behind the cherry tomato. Most people do not recognise that.

Krijn Poppe: Another factor about Wageningen is the food valley. This goes back to the idea from economic theory that it makes sense to have geographical clusters such as silicon valley. The area around Wageningen also markets itself as a food valley. There are programmes for start-ups. This is not to say that companies that are outside the area of 20 to 50 kilometres covering those eight villages do not get support, but it helps to have a number of food laboratories and start-up companies in the same area. There are specific programmes in those areas, for example to improve networking and make joint applications. Linkages are also made between Wageningen and the regional hospital, which by coincidence is one of the biggest in the Netherlands and runs a lot of programmes on health and food. Most of the people who enter hospital, especially the elderly, are undernourished.

Q577 The Earl of Arran: “CAP/RD is not yet much oriented to innovations and competitive position. European collaboration can and should be increased, with JPI, ERA networks etc., to improve efficiency”. Thank you for answering my question about research.

Perhaps you could expand briefly on the importance of European collaboration for the future. Is it feasible?

Krijn Poppe: In the Netherlands, our general attitude has always been that we welcome European collaboration for a number of reasons. Our business is very international and export-oriented. We understand the French and German systems. It also helps with research if you have an international orientation. Some of the research in Europe is getting rather expensive, and one wonders whether there should not be more efficiency in the European system in the coming 20 years if we are to compete with the US or Brazil. We could perhaps make efficiency savings.

European projects in general are often run well. We welcome ERA-Networks and the joint programming initiatives. That is not to say that it is all easy—but it was not always easy in the Netherlands, and probably was not in the UK, either.

Q578 The Chairman: Do you think there is a role for the EU, at European level, to improve farm advice, covering agricultural extension, or do you think that should be left to member states?

Krijn Poppe: We probably have an official policy view on that.

The Chairman: I do not want an official policy view. You seemed to indicate that the Dutch system is working very well.

Krijn Poppe: The Dutch system is working very well. You have already seen my reaction on how we deal with the Farm Advisory Service. Even our official position is not that we welcome a very tight policy, which probably makes sense for some of the newer member states in eastern Europe, but I do not think that one size fits all. That is something we are trying to find out in the SCAR working group on Agricultural Knowledge and Innovation Systems at the moment.

Q579 The Earl of Caithness: Do you agree with the comment that has been made to us that the more that farmers get in subsidy, the less keen they are to innovate?

Krijn Poppe: It is not a straight line. There are examples in the Netherlands. With the high energy prices three years ago, fisheries was a very clear example. As I tell my students, sometimes you need a man, a plan and a crisis. I am not saying that the Government should make a crisis, but sometimes it helps. That is especially so for big system innovations, when the old system does not work and is totally broken. You then have to reinvent a total system, not only one part of your farm. The cherry tomatoes that Peter was talking about is a very good example. That came out of what was called in German the “Wasserbomben” affair in the early 1990s. We had too long been breeding tomatoes for everything *except* taste. It was done on *colour* and on *packaging*, but not on *taste*. That led to a big crisis in the market in Germany. Such a crisis helps, in that sense, if you have to do radical innovations. On the other hand, if it is more incremental, it helps if farmers can pay. If they are totally squeezed and there is no flesh on the bones any more, as we say in Dutch, it is very hard preaching that you should innovate.

Peter Keet: You do not dare to take risks in that case, and innovation is taking risks. For taking risks, you need some reserve capacity.

Krijn Poppe: On the other hand, if you give people €20,000, do they automatically start taking risks and innovating? They could also do some nice other things with that. So it is a policy mix, with a cultural aspect to it.

Q580 The Earl of Caithness: What more, if anything, would you like the EU to do towards innovation in agriculture in a broader sense?

Krijn Poppe: I don't yet have clear news about the policy instruments, but it is clear from science as well as from the Dutch policy perspective that we would like more attention paid to innovation and competition, even in pillar I of the CAP.

Frits Thissen: The Dutch official position on the reform of CAP is reforming the first pillar by granting direct payments in a much more targeted way focussing the money on competitiveness and sustainability, underpinned by innovation. That means getting the subsidies in the first pillar more geared towards innovation, sustainability and competitiveness. That is our line in the debate on the reform of the CAP.

Q581 The Chairman: How is it going to achieve that?

Krijn Poppe: Looking for coalitions.

Frits Thissen: That is a difficult question. There is a fierce debate now going on in the Council and within the European Parliament. You need tailor-made instruments to do that. For instance, now we use Article 68 fully, for instance for a very innovative programme on sustainable stables for husbandry and for precision farming in the arable area. You are limited to 10% of your national envelope now. Whether it is called Article 68 or something else, it does not matter, but we would like greater use of direct payments for these goals.

Q582 Baroness Howarth of Breckland: I was wondering whether you would like to see a blurring of Pillars 1 and 2. We have seen that in direct payments, you have to have greening issues. You cannot do all the reforms without all the other issues coming in, such as sustainability and all those things. There seems to be a very rigid view in the EU of the two, but it is not in reality when you get down to the farm in practice.

Frits Thissen: I fully agree with you. We do not see any blurring problems. We recognise that most of the money on innovation and greening is in the second pillar, but the Netherlands historically has had the same problem as the UK. We have a very small historical right to money in the second pillar. These were policy choices made 20 years ago, also in the UK. We are very much in favour, for obvious reasons—not only founded in history but also for policy reasons to see the money coming from the first pillar, albeit in a much more targeted way. My Minister has a simple message. He says that a farmer does not have a right to direct payments just by calling himself a farmer. A farmer has to do something to get direct payments, by either boosting competitiveness or sustainability. We need innovation to be able to do that and we would like to see a financial basis for this innovation in the first pillar as well. We are looking for partners.

The Chairman: We would be up for it, but we are not in charge.

Q583 Baroness Parminter: We are very interested in the interrelationship between the regulatory framework and innovation. In other markets such as America, there is not all the consumer protection, the animal welfare and the environmental—some would say—constraints that there are in the EU. Looking at your outline answer to question 7, it seems that you are arguing that these are not so much constraints as an opportunity for the European Union to focus on particular areas in order to create a viable future for sustainable farming that will deliver required yields. Is that a correct interpretation, or do you see the regulatory framework as a constraint?

Krijn Poppe: The situation is a little bit greyer than the black and white that you suggest. A few years ago, working for D-G Enterprise, I did a large study on the competitiveness of the EU food industry. We looked, with D-G SANCO and others, at the legal issues. There are clear areas, which SANCO is working on, where legislation in Europe can be made smarter. In food law, too, it is sometimes unclear for producers if they have to be in Brussels or in Parma.

One easy example that I always quote is that the Americans have a rule that if you apply with a novel food to the Government, you get an answer in x days, by law. If you do not get the answer in x days—I forget if it is 50 or 60—you are allowed to introduce the food. That totally changes the situation. A civil servant in this environment, if his Government has a reason or an incentive to be worried, has an incentive to make the process longer and longer. With a rule such as they have in America, you totally turn around the incentive of the committee or whoever decides. In that sense, clever and smarter regulation is possible—and there are other examples. Many countries have programmes for reducing regulations and administrative burdens.

That was how I interpreted your question. On the other hand, the position of Europe in the world is not that we are going to solve all the bulk food problems of how to feed 9 billion people. Exports from a continent with general high income levels will be speciality products: Cheddar cheese, Bordeaux, Burgundy wines or Parma ham. The market will be in Shanghai, São Paulo, Seoul and Singapore, where a lot of rich consumers would like to buy this stuff. That means we will have to deal with regulation and set standards, as we have done with organic farming. Let's be honest: we also created a number of problems. The regulation is not there for nothing: we had dioxins just recently in Germany, and I don't have to tell you about BSE.

Q584 The Chairman: You mentioned that your innovation programme covers the whole food chain. We have dealt to some extent with the farming side, and you have just touched on the food licensing issue. Is there anything else in the food chain that you would like to highlight as an example? It is an interesting concept to take food as an overall industry producing 10% of the GDP of the Netherlands.

Krijn Poppe: Perhaps one additional issue is that our new Government introduced a programme to strengthen the competitiveness of the Dutch economy in this crisis, and selected nine top areas which in total account for 50% of business: that's one-quarter of the economy by a rough calculation. Among them are agriculture and food, water, horticulture and breeding, logistics, chemistry, the creative industries, electronics—and two or three others. The interesting thing is connecting some of those areas. You see it in agro-logistics and a bio-based economy that deals with agro and fine chemistry—but not so much with fuel energy. There are links between agriculture and water management, especially if you look outside Europe. ICT is another relevant area. Robotics, people find it very interesting to make robotics that work in cow-milking, in fields or in greenhouses, because if they work there it is better than if they work in the painting hall of a car factory, and if you want to sell them in the health industry, you have scientific challenges to make robots work in that area. You get interesting combinations for your next wave of innovation. Biotech is another example. We have gone for 15 to 20 years taking the food chain approach and are now thinking of the next step. I sense that this is not official policy, but it will be in this type of area.

Q585 The Chairman: Finally, if member states are given the ability to independently assess GM foods, what will be the reaction in Holland? Is there a big anti-GM movement?

Krijn Poppe: We are waiting for this.

Frits Thissen: The Netherlands sees a crisis arising in the provision of the EU with animal. We have a large intensive husbandry sector and are very dependent on feed imports. The second reason is that Rotterdam is the main port in Europe, so all the problems with inspections and enforcement in this area are for the Dutch authorities. Our former Minister was instrumental in raising awareness about this. Our former Minister was also of the opinion that if there is something to gain in terms of sustainability, we will grow GM food on Dutch soil on the conditions that the food is safe for human beings, animals and the environment and the consumer will be able to make an informed choice. For instance, Wageningen University is working on these GM-potatoes, with trial fields even in the UK.

Krijn Poppe: In that sense there are still large problems of acceptance. We have to be cleverer to convince society, rather than developing something and then throwing it out when we run into trouble outside agriculture.

The Chairman: Thank you very much. It has been a really helpful session.

Supplementary Memorandum by Frits Thissen, NL Agriculture Counsellor (IEUA 38)

During the meeting the delegation from the Netherlands promised to provide the Sub-Committee of the House of Lords with additional information on two subjects.

1. Relative share of land-use of the horticultural sector in the Netherlands

The latest figures for the total land-utilization in the Netherlands are for the land-use in 2006 (source: Land- en Tuinbouwcijfers 2010 Agricultural Economics Institute (LEI-WUR), LEI-Report 2010-063, The Hague, 2010, table 13, page 14) show a land-mass used for all purposes of 33,729 square kilometer (1 square kilometer = 100 hectares and 1 acre = 0.40468564224 hectare). Water has been deducted.

Of this landmass 22,858 square miles (= 2, 285 800 hectares) were in agricultural use in 2006. There is a distinction between horticulture crops, which are grown like arable crops and which partly are the same products (but different species) as horticultural crops grown under glass in greenhouses.

The land-utilization of horticultural crops grown like arable crops was in 2009 98,090 hectares (table 32a, page 66). The land-utilization of horticultural crops grown under glass was in 2009 10,324 hectares (table 33a, page 81). In total, horticultural land-utilization is roughly 4,5 percent of the total agricultural land-utilization in the Netherlands and somewhat more than 3 percent of the total landmass of the Netherlands. As you can see, the real innovative greenhouse-sector absorbs only a fraction of the land in the Netherlands. The output of the sector, however, is enormous. Yields of 60 kilo tomatoes per square meter have been reported in commercial greenhouses and in experimental WUR-greenhouses yields of 76 to 98 kilo per square meter were reported (1 hectare = 10.000 square metres).

2. Top-areas of sectoral policy in the Netherlands

This is a new direction in Dutch economic policy by creating space for development for nine economic sectors through an integral policy for these sectors and pooling of available money (in total 1,5 billion euro). Major elements of the integral policy are: less rules and less administrative burden; availability of venture-capital for risky innovation-projects; better vocational education; lowering of (corporate) tax burdens; dissemination of knowledge and the establishment of a one-stop-service-point for entrepreneurs.

The nine top-sectors are:

- Agro-food (4,4 percent GDP and 500 million euro privately financed R&D)
- Horticulture and propagation sector (1,4 percent GDP; R&D-efforts included above)
- High-tech materials and systems (6,7 percent GDP and 4,2 billion euro privately financed R&D)
- Energy (3,4 percent GDP and 2,1 billion euro privately funded R&D)
- Logistics (3,4 percent GDP and 200 million euro privately funded R&D)
- Creative industries (1,6 percent GDP and 200 million euro privately funded R&D)
- Life-sciences (3,7 percent GDP and 2,1 billion euro privately funded R&D)

Dutch Government

- Chemicals (2,2 percent GDP and 1,7 billion euro privately funded R&D)
- Water (0,4 percent GDP and 300 million euro privately funded R&D)

From the nine sectors two are directly agriculture-related (the first two mentioned). But agriculture is also strongly involved in the other sectors:

- High-tech materials and systems: in this sector for instance nano-technology is covered as well as use of green components in the aerospace and automotive industries. Let's not forget the importance of robotics in the agro-food sector, for instance in milking, processing and packaging;
- Energy: this is mostly about a more sustainable energy sector and in this respect agriculture is involved in second- and third-generation renewable energy sources (use of biomass and waste from the food-processing industry; manure from our intensive livestock husbandry as well as other green energy sources like algae);
- Logistics: for instance one out of every three trucks in the Netherlands is servicing the agro-food industry. Smart logistics is therefore vital for the sector;
- Life-sciences: this is more or less the scientific backbone of the agro-food sector, so involvement in this sector is obvious;
- Chemicals: a large involvement in green chemicals and working towards a bio-based economy;
- Water: involvement in this sector is obvious, because every plant and animal need water, soil and oxygen.

The only sector where a direct link is not self-evident is the creative industry-sector which covers mainly games, design, fashion and so on, but also architecture. Just remember the work of famous Dutch landscape and garden architects, also in the UK, for instance Piet Oudolf with his famous design in the Wisley Garden of the Royal Horticultural Society (weblink: <http://www.oudolf.com/piet-oudolf/gardens/public-gardens/wisley>)

COPA/COGECA

Oral evidence, 2 March 2011, Q 605-629

Evidence Session No. 18. Heard in Public.

Members present

Lord Cameron of Dillington (Chairman)
The Earl of Arran
The Earl of Caithness
The Earl of Dundee
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witnesses

Shelby Matthews, [COPA/COGECA].

Q586 The Chairman: Thank you very much for coming in and giving us your time, which is very useful. I am afraid we have to go in about 40 minutes. This is a formal evidence session. Notes are being taken and you will get a transcript sent to you, so if there are minor errors, please feel free to correct it. In the global, long-term picture, there could be 9 billion people on the planet and it is really important that European agriculture plays its part. We think that getting innovation down to farmers is a crucial part of that, so we are looking at agricultural innovation. To what extent does COPA/COGECA share that view? Where do you see agricultural innovation fitting into your lobbying priorities, for instance?

Shelby Matthews: Our two big concerns are, first, the situation of farmers' incomes, and particularly their dependence on the budget. As you may know, until this year farmers' incomes have been declining or stagnating and are quite low—on average, they are about 50% of average earnings. We are very concerned about the high dependence on the budget. 67% of farm income, on average, comes from the EU budget, including the co-financing. We think this is not a very healthy situation. A lot of our proposals for the future CAP are geared to trying to move farmers out of that position. Improving their competitive position is essential for that, as is improving their position in the food chain. One of the concerns is the low or falling productivity compared with previous years. Growth in productivity has

slowed down. Then, as you say, we are faced with the challenges of food security, population growth and climate change. So for us, innovation is extremely important.

Q587 The Earl of Caithness: Can I just follow that up? You said 67%. Is it possible to break that down compared to the percentage, say, 20 years ago, when people's view of agriculture was very different and the whole agricultural system was different? I know that the EU has got much bigger. Is it possible to take the old member states and say what that is now and what it was 20 years ago so that we can get a comparison?

Shelby Matthews: The big change was when we shifted from price support, prior to 1992, to the direct payments.

The Earl of Caithness: That is why I asked to go back 20 years.

Shelby Matthews: If you go back before 1992, the budgetary support was mainly going on market support and was changing from year to year.

Q588 The Chairman: So it is hard to assess what was EU support in those days, because you got it in the price? And there were protected prices as well.

Shelby Matthews: Exactly. For the amount of time that we can go back with comparable data, it is very much at that sort of level, over the past five or six years or so.

Q589 The Chairman: You say that it is important to increase productivity, and thus the incomes. What do you think is the best way to get agricultural innovation out there? Is it best done top-down or bottom-up? How do we set about it?

Shelby Matthews: There are four main areas. The first is research, which is outside the CAP. We are coming up to the 8th framework programme and we have to make sure that is right. We have the Innovation Union. We have to make sure that is right. There we have the possibility of European Innovation Partnerships, which are new. That is important. Then, as far as the CAP is concerned, we have the advisory services, which are very important and which we feel should be changed and reinforced to some extent.

Q590 The Chairman: That is quite interesting. We have just had some representatives from Holland in here. They said, "Well, we don't really know if they work or not and what they do, because they are just about cross-compliance". It is the same in the UK. Frankly, no one has ever heard of them.

Shelby Matthews: That is what we feel. This has been very much limited to cross-compliance and seeing that it is being implemented. We would like to see a much wider look at the farm, much more geared towards innovation.

Q591 The Chairman: Paid for out of a national budget? That is unlikely in the UK, I am afraid.

Shelby Matthews: There may be some rejigging in the second pillar so that you could put more funds towards that.

That was my second point. The third element in the second pillar is that the Commission has put forward three themes: climate, environment and innovation. We have gone along with that and added a fourth theme of ensuring profitable businesses that obtain more of their return from the market. In a way, I do not see innovation as a separate thing. It is a way of gearing up for climate change and for the environment, and achieving more market-based

farming. I do not see it as a separate theme. Certainly, for us, innovation should be taken in that.

The fourth element is the idea of greening. Our first reaction was quite negative to the proposal of the Commission on greening. We feel that the CAP has been subject to quite substantial greening since 1992, with a whole load of new regulations, which have increased the farmers' costs and reduced their competitive position. It has not improved their possibility to invest and innovate; it has made it more difficult. But the Commission is very much wedded to this greening element. We should aim for green growth and try to find win-win measures that had a positive impact for the environment or reducing emissions, but also had a positive impact on the farmer, enabling him to have better resource efficiency, for example encouraging precision farming, manure processing and biofuel processing on farms.

Q592 The Chairman: You said that innovation should be integrated into every aspect of the CAP. What would your reaction be to a modulated sum of money coming from Pillar I to go into innovation and agricultural extension across the board? How would your members feel about that? It would be a compulsory levy.

Shelby Matthews: This is what the greening would be, in fact. As we understand the Commission's proposals, it would be taking part of the current direct payment and using it for a greening payment. We are not very keen on it being a substantial amount, but if we are going to have that sort of measure, we think it should very much be linked to green growth.

Q593 Baroness Howarth of Breckland: I agree with you about the blurring of Pillar I and Pillar II. We have heard a variety of evidence about that, but we have also heard evidence that suggests that agricultural businesses that are exposed to the market are more open to innovation than those that have financial support. We recognise the difficulties of those movements. You have mentioned that in relation to the dependence of farmers. What is your view of the relationship between CAP payments and the willingness of the agricultural sector to innovate, change and move forward? How should the reformed CAP best support innovation?

Shelby Matthews: Clearly, if you got rid of direct payments—the Commission has published studies showing the impact of that—you would get concentration and intensification of agriculture and land abandonment, with quite detrimental effects in lots of areas. You could say that that is a way of getting innovation on farms. Those farms that were left would probably have a higher level of innovation than we have at the moment. But I do not think that is the way that most people want to go. The aim is to have a much more balanced approach. The problem is how farmers are going to invest when they see such a low return from the market. They have to see a better return from the market.

Q594 Baroness Howarth of Breckland: How do you see that better return coming?

Shelby Matthews: The proposals that we have put forward are for a better functioning market, which is a little bit outside what we are talking about today, and improving the position of farmers in the food chain, but the other one is competition and the emphasis on helping farmers to innovate. One problem has been the link between the research and the farm, and the fact that from the research side maybe they are not sufficiently taking into account what is possible and what is operationally practical on the farm, getting a better link that way. Also, the research that is available is not getting down to farm level. That is where advisory services could help. If these green growth measures are to work effectively, which you would use part of the direct payments to finance, you must link it up with training and

advice so that farmers put those measures into operation and make use of it in the right way. We feel there has to be this link between the two.

Q595 The Earl of Dundee: How far do you think the Farm Advisory System is already working and what might the European Union do to improve it?

Shelby Matthews: As I say, we feel it is very limited. It is very much linked to cross-compliance and to making sure that that operates, so it is very narrow in the way it deals with things.

Q596 The Earl of Dundee: If you could prescribe some improvements for the European Union to take action on, how would you distil or encapsulate those?

Shelby Matthews: There are two things. First, the advice on farm would look at the farm as a whole and would be much more geared to looking at ways of getting what we would see as the win-win situation where you get a balance between more productivity and doing it in a sustainable way and meeting the new challenges, particularly on climate change, so that you get resource efficiency and you would be encouraging crops that are resilient to drought. The other way, possibly, is by much more group training, which has not been developed so much, so that farmers can be trained as a group, which might be more efficient.

Q597 The Earl of Dundee: We have touched on Pillar 1 and Pillar 2. Regarding the Farm Advisory System, would you like to see the strengthening of both its requirement under Pillar 1 and its financing under Pillar 2?

Shelby Matthews: I was trying to say that if we can put what Commission is proposing on the greening measures as green growth, with the sort of measures I have mentioned, such as resource and nutrient efficiency and so on, and link that up with the advisory services so that in implementing those measures farmers have access to advice on how to do it in the best way so that the research is coming down to the farm, that would be best. I am not suggesting that the advisory services come into Pillar 1, necessarily. The problem is always money. How are you going to finance it if you reinforce the advisory services, if you are already going to take money away from direct payments to pay for the measures themselves? Maybe some rejigging within Pillar 2 could shift some of the resources towards the advisory services. That is what I think we would be looking at.

Q598 The Earl of Arran: Criticism on GM and pesticides and a proposed ban on cloning of animals—do you think there is any scope left for agricultural innovation?

Shelby Matthews: We are concerned that we are being left behind. Our position on GM and to some extent on cloning is that first of all there should be choice for the farmer and for consumers. We are always concerned, particularly in the UK, about consumer backlash. We would also like the rules and regulations applied at EU level, because we are concerned about distortions of competition within the EU. Compared with our world competitors, we have one hand tied behind our back, in a way, on these elements. That is a problem, but it is also true on all the regulations that we have within cross-compliance. As I said, we feel that there has been greening of the CAP since 1992; it is just a new word. There is a whole raft of new regulations continuing to come in, with more coming in the future, such as the water framework directive and so on. Our competitors do not face those same rules and regulations.

Q599 The Earl of Arran: Is anything interesting coming out of Norway or Switzerland?

Shelby Matthews: On innovation? Not that I know of.

Q600 The Earl of Arran: Because they are members as well, aren't they?

Shelby Matthews: They are associated members. Because they are not in the EU, they are not full members.

Q601 The Earl of Arran: Both those countries are pretty original in their thinking at times. But there is nothing that you are aware of?

Shelby Matthews: Not that I am personally aware of. My colleagues may be. You have spoken to the Dutch. They are doing quite a lot on innovation. We are drawing up some measures that we think should take on green growth. We are trying to draw on all our members. I will take you up on that and see if our Norwegian and Swiss members come up with anything.

Q602 The Chairman: What do you think about the prospects for the EIP and the new partnership arrangements? Do you have high hopes or do you think it is another unnecessary layer?

Shelby Matthews: At the moment I think we have quite high hopes that this will be a way of bringing together the gap that we see between the research and the farm, bringing in co-operatives and business and involving public and private finance.

The Chairman: If it does that, it will be good.

Q603 Baroness Parminter: The present framework programme for research has a budget of about €53 billion, of which €2 billion goes on agriculture, food and biotech. Do you think that is a reasonable sum, or do you think that it ought to increase when they get round to negotiating the 8th framework programme?

Shelby Matthews: We would certainly like it to increase. We think there are grounds for saying that with the challenges that we face in the future, some increase is warranted. It is going to be difficult, but the importance of maintaining food production and increasing productivity in a sustainable way that copes with climate change and reduces emissions are all things that can very much be helped by research.

Q604 The Chairman: It sounds as though your thinking is along similar lines to ours. I was surprised that you agreed to my suggestion of a compulsory modulation to Pillar I. I did not expect that do come from COPA. It is very good that you do. It is long-term forward thinking. If it compulsory across the board, as you say, it would not take very much.

Shelby Matthews: When you say compulsory, we were thinking that it would a be compulsory amount set aside, but you would have a list of measures that farmers could choose from on a voluntary basis, so they would have the possibility of seeing what was the most appropriate measure for their farm and in their region.

Baroness Parminter: Would that be tick boxes and you could tick three out of five?

Q605 The Chairman: It would be on an individual farm basis rather than necessarily going into either agricultural research or agricultural extension, which is what was in our preliminary thoughts. The problem is who pays. The R&D is sort of happening, but in a lot of countries the agricultural extension is not. The links are not happening.

Shelby Matthews: That is what I was saying about the problem with the second pillar and how you pay for the advisory services now. We are trying to grapple with the idea that Commissioner Ciolos is very attached to on greening. This would be a compulsory part of the direct payment going to those measures. Our concern is that this is going to make farmers less competitive and increase their costs.

Q606 The Chairman: You do not want to make it purely restrictions.

Shelby Matthews: We want to make it into green growth so that it is sustainable and has a benefit for the environment, but a benefit for the farmer as well. That means you have to choose your measures carefully for them to be linked up with the training and advisory services, so that, for example, you get precision farming and farmers know what they are doing. The money for that would come from the direct payments, unfortunately. We feel that the farmers should be able to choose from a list of measures on a voluntary basis. If farmers want to forgo their direct payment and take a cut, not taking up these measures, they should be free to do so. Maybe they have better ways of doing it, but the encouragement should be there for farmers to take up this green growth through incentives by this payment.

The Chairman: Thank you very much, that has been very helpful.

Q607 The Earl of Caithness: Do you see a difference in the views of your members between those in the northern states and those in the southern states about innovation and reform of CAP in that respect?

Shelby Matthews: Not really, no. Clearly, their problems are different. The huge concern in the south is the water problem and drought. The type of measures that you would be looking at would have to cater for the very different circumstances. These innovation partnerships by member state could be geared to very specific priorities.

Q608 The Earl of Caithness: Do you think the EU is flexible enough to do that, on past record?

Shelby Matthews: I see no reason why you cannot have a list of measures that would fit southern countries as well as northern countries. The northern farmers simply would not choose some of those measures because they would not be appropriate. I do not see any difference. All our members are concerned about innovation and the competitive position. That is a clear theme in the position that we have taken for the future of the CAP. Where there is a difference in emphasis, as you probably know, is on something like GMOs. Some farmers want to go ahead and use GMOs, while others are much more concerned.

Q609 The Chairman: But we hope that will be resolved by making it a decision for member states.

Shelby Matthews: We are not very keen on that, honestly, because we fear distortion to competition. We would much prefer an EU approach on that.

Q610 The Chairman: You are not going to get that. They cannot even agree on GMO interventions; it always comes back to the Commission in spite of the scientific advice.

Shelby Matthews: That is a very difficult one.

The Chairman: Thank you very much.

INRA, Scottish Agricultural College, Wageningen University and Research Centre

Oral evidence, 9 March 2011, Q 630-641

Evidence Session No.19.

Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
Baroness Byford
The Earl of Caithness
Lord Cameron of Dillington
Baroness Howarth of Breckland
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witnesses

Professor John Oldham, [Former Head of Research, Scottish Agricultural College]

Professor Geoff Simm [Academic Director and Vice Principal (Research), SAC] **Dr Paul**

Vriesekoop [Head of Animal Science Division, Wageningen University and Research Centre] and **Dr John Williams**, [Animal Physiology Research, INRA].

Q611 The Chairman: Good morning everybody, and thank you for using the technology to interact with us today. If I may start with the formality of this, this is a formal evidence-taking session of the Sub-Committee and a full transcript will be taken. This will be put on the public record in printed form and on the parliamentary website. We will send you all a copy of the transcript and you will be able to revise it for minor errors. The session is on

the record. It is being webcast live and will be subsequently available on the parliamentary website.

The Committee would like to welcome Professor Oldham back. Thank you for giving evidence today. If we start with Professor Oldham and then open it up after that, that may be the most satisfactory way of proceeding. The first question is to get the general scene. We have taken evidence directly from Professor Oldham of the SAC and we have also taken separate evidence from Madame Guillou of INRA. On 2 March we heard from representatives of the Dutch Ministry about WUR. Can you tell us more about the SAC-WUR-INRA link and the Animal Task Force and how these networks came about?

Professor John Oldham: Thank you, Lord Chairman. I will start and perhaps Paul Vriesekoop in the Netherlands will fill in. The SAC-Wageningen-INRA link builds on a longer-standing link that Wageningen and INRA have had over a few years. That is a formal strategic link, which Paul could expand on.

The SAC involvement is not a formal written agreement, but it arose as a consequence of colleagues in Wageningen and INRA recognising the value of joint strategic thinking about research priorities and operations and looking to expand that linkage with other partners, particularly the UK. But while Wageningen can largely speak for the Netherlands and INRA can largely speak for France on agricultural research, there are many bodies in the UK that might possibly speak for the UK and they may not all be saying the same things. Our colleagues in Wageningen and INRA looked for an organisation that seemed to be sufficiently broadly spread that it might have some broader view.

I was personally involved in reviewing the Wageningen animal science programme on a couple of occasions in the last few years, so Wageningen colleagues knew me, and Paul knew me, so there was an element of a personal linkage there that allowed an introduction and expansion of this network.

The aim, as far as we are concerned, has been to gather together a set of research providers who are all interested in common things and wish to share ideas, and then use that sharing of ideas to inform thinking on the broader European stage. Is that a reasonable presentation?

The Chairman: Yes, thank you.

Dr Paul Vriesekoop: Maybe I can talk a little bit about the Animal Task Force, but also about the link between SAC, Wageningen URC and INRA. My name is Paul Vriesekoop and I am the director of the research organisation within Wageningen UR that deals with livestock research. As Professor Oldham has already described, there is a long-lasting relation between Wageningen, SAC and INRA. Several years ago, we made a list of which knowledge providers we worked closely with on European projects. From our side, the animal sciences part, INRA and SAC were always at the top. We know each other very well, so we thought it was logical to start up a closer relationship, also trying to work closely together on European projects.

The Animal Task Force is an idea that started in late 2008 in contact between WUR, INRA and some technology platforms in the animal domain. As you are probably also aware, in the European network we work with technology platforms and in the animal domain we have two official technology platforms—FABRE on breeding and Global Animal Health on veterinary and pharmaceutical issues—and two that are organising themselves now, one on aquaculture and one on feed production. We said that for the future it might be better if we tried to co-ordinate, one way or another, the strategic agenda of the technology platforms towards the European Commission, and the link they have on the other side with the

knowledge providers in the animal domain. In most technology platforms, the knowledge providers are also there one way or another. So we had several discussions about what kind of vision and mission we had. It started with INRA, Wageningen UR, SAC and the University of Bonn. Last year it was expanded to Teagasc in Ireland, MTT in Finland, the University of Aarhus in Denmark and the University of Uppsala in Sweden. I am now in contact with the University of Padua in Italy, who could join, and a group in Spain.

The most important thing that we would like is on the one hand to be a partner for the European Commission concerning policy and knowledge in the animal sciences domain and to become active as a group in putting points on the agenda in Brussels and among each other. One of the most important things that we have seen, which we have to work on, is in the midst of what your Committee is working on: how can we translate more quickly and efficiently the research outcomes of European projects into practice, whether this is with farmers, in industry or in policy? That is one of the things that the technology platforms are very much interested in. They are also interested in coming up with a more coherent view on how we are going to deal with new technology. How are we going to implement things that are important for all of them but no one is looking at, such as welfare? Global Animal Health does not take animal welfare into account and the breeding organisations do not do it so much. How can we as a group address these more social items?

Q612 The Chairman: Thank you. Dr Williams, do you have any further comments to add?

Dr John Williams: I apologise for joining you late. There is one important point to add to what Paul has said. The Animal Task Force has an aggregating effect across the livestock production sector. We now have what is often called a critical mass. We are now large enough to stand side by side with other groups in other sectors, such as forestry, which has a very good and very large technology platform. The same goes for Manufacture, which has the manufacturing industry and with which we should make a link, because they also have agricultural machinery within that platform. The other large platforms that are directly related to what we do are Food for Life and Plants for the Future. Plants provide us with the input for animal feed, which is approximately 50% of the cost of producing livestock.

Q613 Baroness Howarth of Breckland: As you know, we are very interested in looking at the obstacles to innovation. We have been very interested in what has been said about the considerable co-operation that is going on at the moment right across Europe, it seems. We are keen to understand the impact that will bring. Particularly, what are the obstacles to innovation, especially the translation of developments out of research and into application? We are interested in whether they are the same in all parts of Europe. How can the networks that you have just described or the Animal Task Force help to overcome those obstacles? We are really interested in the impact that your networks have. How do you measure that impact? Do you have a baseline? Where do you start in order to benchmark and understand the impact you are having through the networks?

Professor John Oldham: I will begin with a response and perhaps ask my colleague, Professor Simm, to comment before passing on to others. The obstacles to innovation for me come in a number of points. One of the obstacles from a research provider point of view—and some countries in the UK would certainly be among these—is that there has come to be a position where primary researchers feel that it is someone else's job to translate the outcomes of their research into practice while they get on and deal with the next stages of innovation. So there is a responsibility gap there which we discussed when I

met you earlier in the year. It is partly driven by the philosophy of research funding in the UK. It will be different in different places.

Another obstacle in some sectors of the agriculture industry is resistance to change among primary producers. That varies from sector to sector. You might recall that we have discussed previously, in the livestock sector, the difference between the poultry industry on the one hand and the sheep industry on the other. Traditional views hold back some potential developments in the sheep industry, whereas the poultry industry would be much more likely to adopt them more quickly. For some innovations there are also issues of societal concern and how we engage with society with some new technologies that challenge conventional societal and ethical views of what is acceptable and what is not.

You asked how the networks can assist with the process. I think the players in the Animal Task Force that we have discussed are very much drawn from those sectors of research providers that have some interest in applications, so they are kindred spirits in a way and they almost self-select. We are research providers and we wish to see the results of our research endeavours linked to industry thinking at the start of activities and we also wish to see the outcomes translated. Our organisations have some part in that translational process, but not a complete part in all places. By having a network of capability, I hope that as we continue to work together we will learn from each other which things work better and which things do not work quite so well, so we will all improve together. But we are kindred spirits.

The last question was about how you measure impact. That is a challenge. I am not sure that I have a clear answer. The impact of innovation can be seen over different timescales. I will ask Geoff to comment particularly on the way we can monitor that in one area of activity, genetic improvement, which he has done a lot of work in. That is a particularly easy one, in that we have in various countries across Europe very direct linkages between research innovation and translation into practice. The researchers are often working with breeding companies, breed societies and individual farmers. The impact that is seen there is often in the value of the product to the primary producer. One can measure the rate of progress in that because of the nature of the science. In some other areas it is rather more difficult. Perhaps Geoff would like to comment.

Professor Geoff Simm: I am Geoff Simm. I am the academic director at SAC.

The network we are talking about at the moment is very new, so it is difficult to ascribe impact to it, but each, or many, of the members of the network have a longer history of interaction with industry in their own countries. The area that I know best is livestock breeding and genetics and there are some good examples from there. Livestock breeding is a success story in Europe in terms of the translation of science into practice. That has not been without challenges and many of those still need to be resolved, but in the UK many of the breeding tools in use, whether they are statistical, genetic or reproductive, have originated from the research base, as they have in many other European countries.

In the UK, one of the mechanisms that has been particularly helpful in underpinning that is the availability of the LINK research funding mechanism, which sadly is being wound down. In pigs, poultry, dairy cattle, beef cattle and sheep, over the last 15 years or so there have been examples in each species of successful LINK research projects that have helped to develop breeding goals or breeding tools to enhance the efficiency of breeding schemes in these species.

A key feature of those schemes is that they have been able to combine public and private interests. Livestock breeding, crop breeding and many other long-term land uses are quite

complex because they often involve public and private interests. LINK has been very good at facilitating research that combines those. For instance, we have been developing livestock breeding programmes that encompass not just profitability, but animal welfare, animal health and environmental impact, which obviously have strong public as well as private interests.

As an aside, it is a matter of some concern that the cessation of LINK and the starting of the Technology Strategy Board schemes perhaps does not provide as well for those joint public and private interests as Link did. Technology Strategy Board schemes are fantastic for enabling commercially-oriented research, but they perhaps do not capture that joint public and private interest in the way that LINK did.

I should have also said that particularly in pigs and poultry, there have been some good EU projects of that nature in the past, although they pre-date this partnership that we have been talking about today. There are many current proposals being worked on that will take that individual country experience to a European level.

In terms of assessing the impact, there have been quite a few academic studies to look at the economic impact of livestock breeding in most of the species I have mentioned. They have shown benefits of many hundreds of millions of pounds in pigs, poultry and dairy cattle. There have been smaller benefits in sheep and beef, in the order of £20 million or £25 million in the studies we have done, from 10 years of genetic improvement, but there are still very high rates of return on investment, around the 30% mark. We could furnish you with those studies if you wish.

The way that we start in measuring those impacts is to look at trends in animal performance: in growth rate, in milk yield, in fertility, in egg production and so forth. There are good and well recognised mechanisms for tracking those parts of trends in performance that are solely due to genetic improvement. They are very well accepted worldwide. That gives us an excellent basis to measure changes in performance that have been brought about by selection of animal populations.

It is then relatively simple to make some high-level guesses at the economic benefits, but also, from those changes in physical performance, to ascribe expected changes in greenhouse gas emissions, for instance, from the livestock system. There have been several academic studies of that nature, which generally show that improvements in the physical performance of livestock are expected to have corresponding benefits in terms of greenhouse gas emissions per unit of product. In that particular sector, there is quite a good history of being able to trace the influence of practice, to track the benefits and the disbenefits that have been created as a result and to ascribe economic values and some of the wider environmental and societal values, be they positive or negative, to those changes.

Q614 The Chairman: Would you like to add to that, Dr Vriesekoop? We have quite an agenda to get through and a number of questions, so if you can address those for us, then we can move on.

Dr Paul Vriesekoop: Maybe I can quickly respond on how I look at the obstacles to innovation. One of the obstacles that a lot of knowledge providers are working on is a balance. On the one hand, you have to be scientific, so you have to score on your publications in peer-reviewed journals. Professor Oldham has been doing some of these reviews for us. Then they look at the scientific impact. On the other hand, we need to promote innovations. It has to lead to something in practice. Sometimes it leads to people being more focused on the publication record and later on somebody else has to make sure that there will be innovations in the future. When you look at knowledge providers, how do

you balance the social impact and the scientific impact of the work they are doing? In my opinion, there is too much emphasis on the scientific impact, although it is needed, too.

Another thing that I see is that you have the examples on breeding that have been elaborated on by Professor Simm and Professor Oldham. We see that in Holland also. We have close connections with the breeding organisations. You can say the same of the feed factories. The people work closely together. When you are within the feed system, the breeding system or the industry, there is no problem, but when you go a little beyond and go to a systems approach and look at greenhouse gases, ammonia emissions or animal welfare, you are more into a systems approach—the barn, the management, breeding, feeding and so on. Within a specific discipline, people work together, but when they have to work together across disciplines, there is a lack of understanding of how to do that.

When you look at the problems for the livestock sector in the future, there has to be a much more systems approach. One of the things that the Animal Task Force has put in its vision paper is the need to move more towards systems approaches. In that sense, when you want more proper innovations, you have to go into systems analysis first and then come up with ideas, instead of doing all kinds of small steps one by one.

So I think that for the future, to be more innovative in total we have to understand much better how we can integrate and work together over disciplines.

Q615 Baroness Sharp of Guildford: We are familiar with the concept of technology platforms in relation to the framework programme that you were talking about. I wonder if you can give us some examples of successful innovations in the agriculture sector that have resulted from some of these networks and structures, which improve innovation and translation in that sense. What scope do you see for further innovation in the livestock sector? How should innovation in this sector be explained to consumers and to the public generally?

Professor John Oldham: I will be brief. We have discussed one of the best examples, which is in the animal breeding area. The FABRE technology platform has been very helpful there in bringing together various interested parties from the research academic sector and the industry sector to help those players to work together better across member states. Frequently, they work together within member states. That is a particularly clear example of how things have worked well. Perhaps others will bring you other areas. I am not sure if you are asking for specific areas where innovation is needed. If so, innovation in resource use—carbon, nitrogen, phosphorous, energy, manpower—is very high on my agenda there. We also need innovation in the automation of processes and data capture and use of data. That is partly linked to the question about how you measure impact. Frequently it is difficult to measure impact because we are not monitoring the things that may be the outcomes.

Q616 Baroness Sharp of Guildford: Perhaps I should make it clear that we are interested in new areas of innovation that lend themselves to these co-operative structures. Perhaps we could have some comment from Dr Williams and Dr Vriesekoop.

Dr John Williams: You asked for an example, so I will give you one from animal welfare, which is a relatively new field compared to animal nutrition or breeding. I have the history of a network that started off in the COST system early in 2000. That is a simple co-operation network, which requires a very low input in resources—about €100,000 a year—because you are just co-ordinating nationally funded research efforts. That gathered a very large number of countries together. I think it was 23 countries across Europe. That is one of the important points. You asked whether the barriers are the same across Europe. We do not

know, but we know that the agricultural systems are not and neither are the societal structures. You cannot ignore the way that each country has organised and operated its own production sectors. That is the first point. Get the people together. It requires a very small amount of money for this co-ordination work. Get them into workshops, organise some exchange visits and develop some best practices. This is what they did in the COST network. They then went on and were successful in a bid for a network of excellence

This was under FP6, so I am going back in time. That network of excellence gave them a large amount of funding. People are currently implementing a welfare quality scheme, which is a training scheme for farmers across Europe.

There you have an innovation and the history of it. It took three years on the COST network and four or five on the network of excellence and now they are implementing it. From the inception of the idea to the implementation took 10 years. That is not bad going, although everybody would like faster innovation. This is an example that I know well in a new sector.

I would like to add and agree with what Professor Oldham and Professor Simm said about the tradition in the sectors and the difference between the sectors. It is well illustrated by the example of aquaculture, which again is a very new sector. We know that the links between the research providers and the professional sector are much closer there. They do not have a long social history behind them. They know they need innovation. For example, at the moment they are very concerned about the welfare of fish. That is in quite strong contrast to more traditional sectors such as dairy farming.

Dr Paul Vriesekoop: Can I add something to that quickly? My example would also be welfare quality. Professor John Williams has just explained this and he has much more history on this, but the nice thing about it is that out of the welfare quality project, there is also now a grouping of industries, for instance the supermarkets and the processing industry, who are now in discussion with the people who lead throughout the quality project about how they can implement the welfare quality standards in the products that they bring to the supermarkets or the products that they process.

For instance, McDonald's and Albert Heijn are within it. I am not familiar with other members, probably also from France and the UK. The nice thing about it is that from a project and now training farmers, it is already also putting it on the agenda at the supermarkets and so on. That is a good thing about what has happened.

Professor Oldham has already given some ideas about research and innovation and where we have to look. I can speak more from the Dutch side. We are a country with a lot of animals, a lot of people and a small surface area. When we encounter something, you see it in other countries within three or four years. One of the most important things within our system, where we have to come up with ideas for innovations, is to deal with emissions from farms, whether it is fine dust, methane or ammonia, but also the discussion around new barn types and zoonoses, so that diseases that are within a group of animals do not spread to the human population living around it. We had some examples of Q fever last year in Holland. Some people died of it. In the future, the human health aspect of managing animals, whether in big or small farms, will become a much more important issue for the future.

Professor John Oldham: I am not sure that we really dealt with the part of the question about how we explain innovation to consumers and the public generally. Do you want us to comment on that?

The Chairman: Actually that would be very helpful if we could take a couple of minutes to do that.

Professor John Oldham: It is a very challenging area with a number of aspects to it. For really novel technologies that are in the course of development, scientists have traditionally not engaged well with consumers and the broad public in the early stages of research activity. In part that is because it is very difficult to do. How do you choose the right people to engage with? But for challenging technologies, we should be looking in our research activities for ways to engage with groups that represent the interests of consumers and the public at large during delivery stages.

One of the most powerful ways of engaging with the public is through the media. I cannot speak for other countries, but the television and radio presentation of agricultural developments in the last few years has been much more balanced and sympathetic to the industry interests and has moved away from the Frankenstein farm approach, which typified a lot of UK coverage of new developments until a few years ago. I am sure that is very powerful, but it is important that we have scientists who are comfortable engaging with that kind of process, as part of their training.

We also find with the general farm open days that we regularly hold that, while we do not always have huge numbers of the public coming to look at research farms and activities, those who do come find it a very positive and eye-opening experience. So there are a number of aspects, but the willingness of the scientific population to engage with the broader public is key to that, as is training people to be able to do it well.

Q617 Lord Cameron of Dillington: I wanted to talk about how we promote more of the good work that you gentlemen are involved in. There are now 27 member states in Europe and there must be a wealth of scientific skills and projects across Europe. To some extent Dr Williams has already touched on this, but there must also be variable resources in efficiency and models of agricultural extension. I wonder whether the EU should be doing more to achieve more co-operation, to pull in more players and to promote better models of extension. Or maybe it should just be left to national discretion. Maybe it could be more advantageous to have partnerships from outside the EU club, for example with organisations such as Embrapa or CGIAR. I wonder what your take on that is.

Professor John Oldham: There are real challenges in my mind in seeing how Europe as a whole might engage in translational extension services. Those services may be based within member states, but they are often linked to individual institutions or companies, so they are potentially transnational but may be based in individual places. When we met previously, I think I mentioned that SAC, though based in Scotland, now has three offices in England. I know that they are both parts of the UK, but there is an important psychological barrier between Scotland and England that I think we are all aware of, especially with the coming weekend. There is no bar to operating transnationally, even if organisations are based within member states. I would be interested to hear colleagues' views on this, but I am not personally convinced that it is something that the EU could easily do that would be any better than member states' or individual institutions' activities.

Dr Paul Vriesekoop: May I elaborate some of my ideas a little? It would be wise if not just from European Commission or the European Union, but member states themselves promoted much more awareness of their research agendas. I have been in this position for about six years and I am still wondering sometimes why countries that have the same problems do not look at one another and ask whether they can do more things together. You see it coming up a little more now with joint programming initiatives and ERA

(European Research Area) networks. It would be much wiser in the future if you could have an agenda for the European Union, but a lot of countries that have an agenda in livestock or agriculture could bring things together and efficiently use the resources—scientists and money—to not try to do everything in their own institutions, but try to work together between countries on the same idea between institutions. I see it coming up now, but it can be done much better, much more and much more efficiently in total. Across Europe, a lot of research is being duplicated, if not quadruplicated. They are doing the same thing in Denmark, and here in Holland and in Spain. If you link the strategies of these countries, you can make better use of it and learn from one another, which is important.

Another thing that you mentioned was about extension. You will probably have been told by the people from the Dutch Ministry that there is no state extension service in Holland any more; it is all privatised and done by companies—feed companies or breeding companies or sometimes privatised extension services. There might be quite a difference in the need and demand from farmers or industry on the type of extension. For instance, in Poland where you still have a lot of small farmers, I can imagine that working with an extension service can help farmers to develop themselves. Working with demonstration farms can help farmers to develop themselves. If you take the Dutch situation, where farmers are entrepreneurs and are much more individualised, a farmer who wants to invest is not going to a demonstration farm because he is going to visit someone in Holland, or even in England or Spain, who has been building a barn or using a particular type of innovation. They look at each other. In Holland we have a project called the Dairy Academy. It says that farmers learn from farmers. If they have a problem or a question, instead of going to the research institute, they first find out each other's experiences and try to solve the problem themselves. They are helped by research institutions. What you see more and more is that there are differences between countries. In some areas farmers develop themselves. A lot of farmers in Holland have a polytechnic or university background. They are not looking for demonstrations. They are on their own. You have to facilitate them finding these things and having discussions with them. Within Europe, there are differences. In some areas you can work with extension; in other areas farmers have their own problem-solving way of working.

Q618 Lord Cameron of Dillington: If I might comment on that, scientists talking to farmers can develop themselves the other way round. It is very important that scientists get out on farms as well.

Dr Paul Vriesekoop: Yes, perfect. You are right.

Lord Cameron of Dillington: Perhaps Dr Williams would like to comment.

Dr John Williams: Thank you. I have two specific points. As you said, we are EU27 at the moment and we may be EU30 or so in the future, with the candidate countries. We euphemistically refer to the new member states, but they are not so new now. We were recently at a meeting at the Hungarian Embassy in Paris for an initiative presented by a series of central European states who wanted to do something together on livestock production. We discussed an outline structure for this and we were then told that we would have another meeting at the end of the year. This did not happen. The economic crisis may have something to do with this. If there is one area that Europe as a whole could target a little more precisely, it would be the new member states. EU knows there is a demand, but we have to work out some kind of tool for helping these member states, because there is a huge reserve of competence in these areas. These are people who have been starved of resources for years and years.

They also have a very large reserve of biodiversity, in ancient breeds. This would be of great interest to us to be able to learn more about these animals. There may be some very useful genes hiding away in some rare breed that could come into a breeding programme and help us to make progress.

The other thing is that we need to strengthen the links between research and education. At the moment, you may know, what we call DG-RTD, which is research and technological development, will become DG-Research and Innovation. That is our central point this morning. At the same time, one of the education programmes that they ran—the people programme, or Marie Curie, as it was called in the past—is going to move to DG-Edu. This is logical, because DG-Edu, on education, manages the Erasmus programme for exchanges between universities. Grouping these programmes together is a good idea, but it is a bad idea in the sense that it is in two directorates. If we want something to be effective for us, we need knowledge transfer and we often need training. Therefore we will need DG-Edu to come in on research programmes that would still be run by DG-Research. Historically, this has been a barrier. The directorates in the European Commission are very independent entities—rightly so for many reasons, I am sure—but we need to work on this level to encourage DG-Research and DG-Education to co-operate very strongly in the future.

Dr Paul Vriesekoop: Can I add something on this? I would like to stress the position of small and medium enterprises. I am not fully aware of the position in the whole of Europe—I have a clue—but in Holland we focus a lot on the industry and then we look at the most important players in the production chain. They have a large turnover, so we think they are important. But the innovation strength of the leading large companies is often much lower than the second or third companies.

What we see in Holland is that in general the SMEs are much more innovative than the larger companies. When we want to co-operate on a project we always go to the large industries because they have their own researchers and it is much easier to discuss. On the other hand, you have the small and medium enterprises which, as people, are much more innovative. I do not have a solution, but that is something we have to take into account. How can we use that to become much more innovative overall?

Q619 The Earl of Caithness: Are any of you working with organisations or countries outside the EU?

Professor John Oldham: Yes, I think we all are.

Professor Geoff Simm: I think the development of EU research calls that involve non-EU partners is very positive. We are increasingly tackling issues of global significance, such as food security and climate change. It is highly relevant that these involve sub-Saharan African partners, South American partners or Chinese partners where they are major players. That is a very positive development in the recent past.

Dr Paul Vriesekoop: From our side, we are also working with a lot of institutes from outside the European Union, mostly with China, with Embrapa and with some universities in the United States. I am the co-ordinator of the non-ruminant and manure group within the Global Research Alliance on greenhouse gases. There we have Mexico, Colombia, Chile, Brazil, Malaysia and Thailand. We have quite a strong experience of working with others on these more strategic items.

Dr John Williams: I do not think I have much to add. I know you had an interview with Marion Guillou, who is my president and general director. I would be very surprised if she

did not tell you that the international dimension is one of her main themes for the current strategic programme of INRA.

Q620 The Earl of Arran: Moving on to the CAP and its responsibility for energising and stimulating innovation for more competitive agriculture, what part do you see the EIP playing in this from the point of view of bringing about a substantial, positive and constructive role in so doing?

Professor John Oldham: The innovation partnerships are a new concept. As far as I am aware—you might correct me on this—there is not yet an agriculture and food innovation partnership, but I know that is on the list of ones that are likely to come in following the pilot. They seem to me to be an excellent idea. Pooling interest and expertise to address the grand challenges that face Europe and other parts of the world seems to me to be a very logical development. You may be aware that across the Scottish universities there have been a number of exercises pooling academic capability. The difference with the innovation partnerships, as I understand it, is that the aim is to bring together stakeholders from across the spectrum of industry application through to research-based organisations to work together on delivering major goals.

So the concept is very strong. The challenge is in implementing that concept in a meaningful way so that the players really share joint ideas and work together to deliver them. In a very small way, the Animal Task Force is trying to do just that, bringing together interests from research providers, industry and potentially also policy interests to work together in that sector. As Paul was explaining at the start, that has been one of the big driving forces for us getting together to share that expertise. I can see that that mechanism is potentially attractive.

The political hurdle of linking that to a change in the philosophy of the spend that is currently under the label CAP is a major one. I think it is rather more in your area of expertise, as people expert in the political arena, than in mine. I can see considerable logic in using the innovation partnerships to identify the areas of activity that might be supported through policy instruments under the CAP to help stimulate innovation, but again, as we discussed last time, that is potentially a political hot potato. There is potential in the immediate term lost to those who are receiving CAP support in the current model. To link the innovation partnership approach to identify what needs to be done and to try to use that as a way of devising instruments to help modify the dispersal of spend under the CAP to stimulate innovation seems to me to be a good idea.

Dr Paul Vriesekoop: The nice thing, as far as I can judge, is that when you look at the European innovation partnerships, they have now come up with the grand challenges. It also has to deal with a vision of where you want to go. In the future, we will have to feed a world with 9 billion people who are going to eat more, but also they are going to eat more animal protein. At the same time we have to bring down the ecological footprint, because we have only one planet Earth, not four. If we carry on the way we are doing it now, we will probably need four of these planets to support everybody. That also takes into account all the fuel that we are going to need.

The grand challenges are a good way of addressing these issues, but it has to be translated into practice. What are we really going to do and what are the plans for agriculture, whether it is livestock or crop plants or whatever? You have to fine-tune it one way or another and set out the strategies that will be laid down to get these things working and work out what kind of research you need. It is a nice idea, but how are we going to develop it in practice? As Professor Oldham said, how are we going to get it working? When you look at the fact

that farms are going to be more based on ecosystems in the future, it can be a very important tool to come up with other ideas and systems, also on a regional level, of animal or agricultural production. Then, within CAP, there must be sufficient attention and money to make it happen. If you want to get a development, you will have to go beyond the discipline or the farm and look at a more regional level, taking into account all the things that you would like to develop within the European Innovation Partnership.

The Earl of Arran: You are making a very good case for making this happen.

Q621 Baroness Byford: I wonder if I can throw in a question that is basic to the future, which is about how we improve our yields, how we control disease, how we use our water and soil and stop pollution. In innovation, one of those keys has to be the future use in Europe of GM technology. I wonder how the group would respond to that.

Professor John Oldham: In principle, GM is a technology that has potentially huge advantages. Like all developments, it needs to be tested for efficacy and safety, but there should be no objection in principle to the adoption of GM and I cannot see that GM will not be in widespread use in the future. We tend to think of the future as the next few years, but if you look 100 or 200 years into the future, it seems to me obvious that it will be the norm, and it is an issue of progression towards that. But, as I said, as with all developments it needs to be tested for efficacy and safety so that we progress in a logical way. I have no ethical objections to the use of GM for a number of purposes. When it comes to livestock, we need to be careful to make sure that we do not compromise the interests of the animals themselves, compromising their welfare in the broadest of terms. Otherwise, I think it has to be part of the future.

Professor Geoff Simm: I agree entirely with what John has said there. But I think there may be a danger that we see GM as a silver bullet to a lot of the problems that we face. There has been massive investment in genome mapping in domesticated species over the last couple of decades. While that has contributed enormously to knowledge and delivered benefits in human and animal healthcare, or is beginning to do so, it has had relatively limited application in livestock breeding—there have been more in crops. One of the reasons for that is that we have learnt, as a result of that investment in genome mapping, that many of the characteristics of interest in animals and plants are under the control of many hundreds of genes. That means that it is quite difficult to alter them through genetic modification of the direct type. Using that genome mapping information to identify families or individual animals through a process called genomic selection is possibly more applicable. There are many other applications of the burgeoning information from livestock genome mapping, short of GM, that can make many useful contributions to meeting these grand challenges. In many cases, they may be more appropriate than GM simply because of the number of genes involved in traits of interest. That whole area is one of major opportunity for Europe and it is where networks can have a particular contribution, because of the costs of the technologies and the need to share skills and create joint approaches to exploiting them.

Dr Paul Vriesekoop: Maybe I can add something on that. I agree with Professor Simm and Professor Oldham that there are huge opportunities, but there are still a lot of differences between farms, between entrepreneurs and between animals themselves, which could be exploited and could help us to close the gap that we see in differences between farms. As Professor Simm said, GM in livestock is not a silver bullet.

I am more worried about the discussion in general on GM also in plants. Worldwide, GM crops are already used a lot in the United States, in Brazil, in Argentina, in India and in China. We also have to take into account that Europe is a net importer of plant protein to produce

animal protein. This plant protein is more and more grown from GM crops in other parts of the world. If the European Union does not move ahead more on GM, in the end we might be faced with legislation in Europe that we cannot even import any plant protein any more. In that sense we already have a problem because we do not have plant protein to feed our animals to produce our own animal protein from our livestock industry.

For the short term, the focus should be on getting GM plants adopted in European law much more. I agree about the nice visions of what we can do with GM, but we have to act more quickly in Europe.

Dr John Williams: GM is just one biotechnology. I would like to see the emphasis shift to developing new biotechnologies—plural. We have other ideas, such as gene silencing, which need to be developed to see if they have promise. The second thing is that we have to consider very seriously the coexistence with the organic farming sector, which is very strong in other countries in Europe. For example, in Switzerland and Austria it is at least 25% of the market. Coupled with that, we have to take on board what we see, certainly in France, as a growing concern for the links between food and health, and a growing desire to reduce contaminants in food. Should we reduce pesticide use? Yes. Should it be done by the use of a GM plant? That is still a question mark.

Baroness Byford: Thank you very much.

The Chairman: I am very conscious that we are running over time, but if everybody could spare just a few moments more, I think Lord Caithness would like to ask a supplementary.

Q622 The Earl of Caithness: Following on from your excellent paper, when you are looking at animals as systems and animals in systems, is there going to be anything visibly different in 20 years' time? What are the implications for higher costs as a result of higher welfare? Through the innovations that Dr Williams talked about, is this going to make Europe more uncompetitive when it comes to animal production? Will farmers need to change to take account of your innovations and in what way will they need to change so that they can absorb the information that you are producing and utilise it?

Professor John Oldham: There is a wealth of questions in there. On the higher costs and higher welfare issue, higher welfare does not necessarily imply higher net costs. Some of the work that our colleagues here have been doing on economic modelling of the impact of welfare standards on trade shows that it does not necessarily follow that high welfare is high net cost. There may be net benefits through high welfare. The actual costs may rise, but the returns may rise higher. There is a thing called partial equilibrium modelling, which I do not fully understand so I could not explain it anyway, but by combining research on welfare and some economics, it is possible to get a feel for the implications. It does not necessarily follow that high welfare is high cost.

What will we see different in practice in 20 years? I am confident that we will be moving in the direction of much more integrated systems, where the concept of waste is diminished and the outcomes of one part of a system may be used as inputs to other parts of systems. That may well be applied across units of production as well as within units of production. I think that will be significant.

I am old enough now to recognise that 20 years is not that long. The visibility of that change may come through in a slightly longer timescale, but I am pretty sure that greater integration of activities to improve use of resources will apply. That could often mean larger-scale units in production.

Your last question was about how producers should change to adopt our innovations. There is just as strong a question about how scientists should change to work more effectively with innovative producers. Innovation does not always start with scientists. Innovation starts in all parts of the network that links producers to scientists and so on. I would not want to isolate the origin of innovation in the science community. I know some of you are from a farming background. Farmers are incredibly innovative people. Scientists working with innovative farmers can double the value of innovation. We should aim to have training and education systems that develop young people who are going into the farming industries to be prepared to be good businessmen, good practitioners and good innovators, but we should also look to change some of the research culture so that it is more normal for researchers to interact with producers and industry and learning together.

Professor Geoff Simm: That perhaps was not clear in some of the earlier discussions. A key feature of some of the successful examples that were given before of research going into practice has been involvement of those end users from the start.

Dr Paul Vriesekoop: I agree with John Oldham. When you start working on new systems, most of the time you will probably be faced with more costs. We have an example here in The Netherlands. Around 2000 or 2002, we started with a project that in Dutch is called Houden van Hennen—in English that means caring for hens. The idea was to build a new system for laying hens and call it a five-star hotel. Look at it from the perspective of the hen. We had scientists, architects, farmers and people from the supermarket looking at it from the perspective of the hen, of the farmer and of the consumer and bringing that together. We developed two new systems. We presented in 2005-06 and then it took about three years to organise that a farmer, someone who builds barns, the Ministry and a supermarket like Albert Heijn would join in, seeing the advantage. More and more of these barns are being built in Holland. The eggs all go to Albert Heijn. Albert Heijn is paying a premium. It is changing the way of buying the eggs, not on a daily market price, but based on the price of feed. That is an innovation. The supermarket is buying directly from farmers. There is no packing station in between. When the price of feed goes up, the price of the eggs goes up. When the price of feed goes down, the price of eggs goes down. At the same time, we have more square metres for the animals and a much better environment for them and the emissions of the farm are lower. The Animal Protection Agency was very much involved and now it is a three-star system. The public are paying a little bit more, but by building the next generation of barns, called a roundel, the price is going down also. At first you need a little bit more cost, but then these entrepreneurs start with it and prices go down again and costs go down again. When you have a good story for consumers, they are prepared to pay more for it. At this moment, there is a shortage of these eggs in the Dutch market.

Dr John Williams: I completely agree with Paul. Any supermarket manager will tell you that they are supplying not just one market, but several markets. We see this very clearly with agricultural products. There are any number of quality labels that are European, or were national and are becoming European. France has a good number of examples with wine and with cheese, which you know about. We can see that when these labels work, it is recognised by the public and it secures a market for the products. This means that it secures a livelihood in the rural areas. That is a very important point. In agriculture, we have to consider at the same time not only the rural areas, but the large-scale production systems. This comes back to the question about how we feed the world. Essentially, we have to feed the largest numbers of the population with very large-scale production systems. In livestock, this means poultry and pig production systems. In both cases, we see now that the area of concern is that the animals that we developed for these very highly producing systems are very fragile. They are no longer what we call rustic or hardy animals. We know that we need

to reintroduce this character into the animals for the future. This is very easily said, but it is very difficult to do. What Professor Simm said about genomic selection is, for us, one of the ways to do it, but this will undoubtedly produce innovations for these large-scale production systems for the future.

The Chairman: Professor Oldham, Professor Simm, Dr Vriesekoop and Dr Williams, this has been a most stimulating session. We are very grateful to you all and we are grateful for the technology working. We shall reflect on what you have said. Thank you very much.

Professor Charles Godfray

Oral evidence, 16 March 2011, Q 642-672

Evidence Session No.20.

Heard in Public.

Members present

Baroness Sharp of Guildford (Chairman)

Baroness Byford

Lord Cameron of Dillington

Lord Giddens

Baroness Howarth of Breckland

Baroness Parminter

Examination of Witness

Professor Charles Godfray, [Head of Department of Zoology, University of Oxford].

Q623 The Chairman: Good morning and welcome, Professor Godfray. We are delighted to have you with us. Some of us attended the launch of the Foresight report along the corridor a couple of weeks ago. Most of us have read at least part of it and, I have to say, are very impressed indeed by it.

You have in front of you a list of the interests that have been declared by Members of the Committee. You will recognise that this is a formal evidence-taking session of the Sub-Committee and a full transcript is being taken. This will be on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript in the next 10 days or two weeks and will be able to revise it for minor errors. I should also tell you that this session is on the record and is being webcast live and will subsequently be accessible on the parliamentary website. I do not know whether you would like to start by saying anything about the Foresight exercise and your conclusions, or whether you would like just to go into questions.

Professor Charles Godfray: I am happy to go straight into the questions.

Q624 The Chairman: One of the key conclusions in your report is “the need for policy-makers to take a much broader perspective than hitherto when making the choices before them—they need to consider the global food system from production to plate”. Considering that broad perspective, to what extent should the EU and its Common Agricultural Policy aim to take the lead and, so to speak, feed the world—it might be simpler to talk about raising productivity? How far can agricultural innovation meet the challenges facing the global food system from production to plate, and how is it best promoted by policy-makers? To what extent can the shortfall in production be addressed by reducing waste in the system as opposed to increasing agricultural productivity per se?

Professor Charles Godfray: Let me preface what I am going to say by emphasising the point that you made right at the beginning, one of the main conclusions of the Foresight report is the need for a much broader perspective on the food system. Several dimensions need to be added. One is the global dimension: the food system that we in this country and in Europe inhabit is part of a globalised food system. Secondly, the food system needs to be looked at in the round—not only production, but issues of demand and efficiency and everything within a sense of sustainability and the needs of the poorest people in the world.

To address your specific question about the EU and the Common Agricultural Policy and whether it should feed the world, there are two ways in which it can contribute to feeding the world. The first is as part of the globalised food system. Inevitably, food is globalised. The issue is how one can make globalisation work for the betterment of food security. There are challenges for this country and the EU to lead on issues such as trade negotiations. Although it is always extremely hard to pin down specific events to climate change, I suspect that we are already seeing today really major production shocks that are affecting quite large regions. As climate change inevitably kicks in over the coming decades, one of the ways in which globalisation can work in favour of food security is by replacing a single bread basket feeding a region, with a globally interconnected set of bread baskets so that when there is a horrific production shock in one area, the food system can adjust to it. As one of the major trading blocs in the world, the EU can have a major effect in promoting this globalised food system that works for food security.

Q625 The Chairman: One of the dangers is that when countries get worried about food security, they rush to protection of one sort or another. I take it that you are saying that the EU needs to be firm in its commitment to freeing up trade in this area.

Professor Charles Godfray: We saw exactly that happening in the 2008 food price spike, especially in south-east Asia with rice, which is a particularly interesting commodity. Encouragingly, in the current food price spike, we are seeing less of that, so lessons seem to have been learnt even over the last couple of years.

The second arena in which this country and the EU can have a major effect is that we are a powerhouse of creating knowledge. Much of the innovation that low-income countries are going to require to meet the food challenges ahead—challenges of demand to feed their population, but also the challenges of climate change and environmental degradation—is going to require the type of knowledge creation that, although not exclusively, this country and the European Union are very strong in.

You also asked how far agricultural innovation can meet the challenges facing the global food system. The report argues quite strongly that there is a very important role for agricultural innovation, but that the magnitude of the challenges that are going to face the global food system are such that it is not just a case of increasing productivity, it is also looking at the demand side as well as the governance and institutional structures of the food system. There

is also a large amount that we can do immediately with our existing knowledge – here much of the issue is spreading best practice - but we are going to have to invest in new knowledge coming in the future. This is going to be new knowledge of a different kind from that which traditionally we have asked our agricultural research institutions to provide. It is going to be not just increasing yield, but looking in particular at resource efficiency. If one is looking at low-income countries, it is going to be increasing yield in crops that have been neglected by the biotechnology revolution in the last few decades.

Finally, it is not just biotech. That is extremely important, but there are critically important areas of agricultural sciences in general, for example soil science and traditional agronomy, which the Report concludes have been relatively neglected over the last few decades.

Q626 Lord Giddens: I would like to congratulate you on the Foresight Report, which I thought was really interesting and gripping reading. You talk about the globalisation of food production. Do you worry about the role of large corporations in this process and how far they are affecting diet? There has been an extraordinary growth of obesity across the world, which follows the fast food industry. If you look at the case of Japan, China or many other countries, that role would seem to be, in some part, a difficult and somewhat noxious one.

Professor Charles Godfray: Yes, it is hugely complex. If you look at the growth in obesity, especially in a middle-income country like Mexico—

Lord Giddens: It is number two in the world for obesity ranking.

Professor Charles Godfray: Exactly, and although Mexico has got rid of overt hunger, it still suffers from micronutrient deficiency, so it is having the double burden. I am not sure it is the number of corporations that are responsible for that; it is other trends. As societies, especially middle-income countries, become increasingly urban, they are amenable to any company that is able to take advantage of our natural predilection for sweet or fatty foods. The economies of scale allow you to do that in an urban environment, which you cannot do in a poor rural environment. Much of this easily available food is nutritionally poor. I agree with you that this is a huge challenge, not only in middle-income countries but in high-income countries as well.

Q627 Lord Giddens: Japan is an example of a high-income country which had one of the healthiest diets and greatest longevity in the world. If you look at the statistics on Japanese children under 21, there has been an amazing growth in the level of something approaching obesity and being radically overweight. You also have enormous demand for the production of meat.

Professor Charles Godfray: Absolutely. I have no answer to it, but I see the challenge as addressing the levers of demand modification. How can one persuade people to change their diet? I am not sure that the issue is the structure of the private sector—whether it is a few very large firms or many small firms. I think the demand is there, and it is how one changes that demand, either by behavioural modification, by regulation or by fiscal measures.

Q628 Lord Giddens: I do not want to take up the time of the Committee, but I think we live in a world where corporations are not picking up the social costs of changes in behaviour patterns that they promote through advertising. I think there should be much greater regulation nationally and internationally within the global food system if we are going to contain these trends, which have massive health implications, as you know.

Professor Charles Godfray: I think I would agree with you. I was making a narrower point about whether it is the structure of a small number of actors or a larger number. One could

argue, although this is not my area, that a smaller number of actors might be easier to engage with corporate social responsibility, but I would not want to push that.

Q629 The Chairman: Can I go back to a point that you made about the UK being a powerhouse for creating knowledge, but also raising the fact that when we are looking at where new knowledge is coming from, it is not just biotech? In some senses we really need more intensive use of some existing knowledge. One thing that concerns us as a Committee is the relative neglect of R&D in agriculture over the last 20 years or so. Would you like to say anything about that?

Professor Charles Godfray: I think the relative neglect is quite easy to understand. Over the last 30 to 40 years, food prices have been at historically low real levels. The problem in the UK is that we have been producing too much food. (My own research has involved aphids. I remember being told that the more aphids, the better, because it was reducing the burden of subsidies. -!) That has been one of the reasons why there has not been this investment. The killer, of course, is that there are enormous time lags in the system. I hope the report tries to argue that there is an extremely high probability that we will be facing major food security issues by the middle of the century. That requires investment now in a suite of areas of research. I would go back and stress that there is an enormous amount that we can do at the moment. You will probably get on to extension services and issues such as that later on. The jargon terms are closing the yield gap and spreading best practice. We can do a lot at the moment, but I do not believe that that is not going to be sufficient to meet the challenges, especially new challenges such as salinisation of agricultural land and the huge competition that there is going to be for water. Water scarcity is something that will rear up and bite us sooner rather than later.

Q630 Lord Cameron of Dillington: To generalise, your report states that we should not exclude new technologies. I think that most people in the Committee would probably agree with you. Bearing in mind the current political situation in Europe on many biotechnologies, what role should the UK and the EU play in this field? Who should be responsible for promoting genetic modification or new biotechnologies of various sorts? Should it be politicians? Should it be scientists? How can we persuade the world that this is a proper way forward?

Professor Charles Godfray: This is probably wishful thinking, but it would be nice if we could demote GM a little bit. GM is extraordinarily important, but it is one of a suite of innovations from high-tech to low-tech that we need. Some of the most exciting things, which I am sure you have had evidence on, are utilising new knowledge from genomics, but not using GM, for example marker-assisted selection. I realise that this is wishful thinking, but it would be nice if there was an appreciation that there was a spectrum of new technologies of which GM was but one part. We should also not forget the low-tech things we can do that do not require massive modern biotech.

To go from the airy-fairy to the more concrete, my belief is that successive UK Governments have done what they can to promote a more balanced view of GM. I am not sure, given the way that society treats Government today, that it can do much more. Scientists are now much more savvy than they used to be. In the past I have seen scientists get up and shoot themselves in the foot by being unrealistically over-enthusiastic though it is of course understandable is natural for people working in an area to try to sell it. Scientists are more sophisticated these days.

Parts of the media are excellent. Parts of the media essentially make money by spreading scare stories. Debating GM is difficult, because different parties adopt different rules of engagement. Most scientists are out there trying to argue logically the positive and negative health or environmental consequences. But there are large interest groups who argue against GM knowing the answer and then working backwards. It is frustrating not to have an uncontested space where one can argue on a level playing field.

Parts of the scientific community have been slightly narrow in only thinking about health and environment, whereas there are important general issues of intellectual property and the governance of the food sector, which are tied up with GM. It is quite legitimate to argue about them. When the report talks about respecting people with a contrary view, part of that is realising that it is not just arguing yet again that the chances of environment or health disbenefits from GM are low, for which the evidence is strong. Health and environmental issues can be used as proxy arguments for those issues and it would help the debate to address them explicitly.

I think some of the most trusted commentators in this area are NGOs. I have spoken to senior people in humanitarian and environmental NGOs who are grappling with issues such as whether to embrace GM technology to help the very poorest in Africa. It is a very difficult issue for them, because they also have to consider what the general public would think. If I had a wish, it would be that one or two of the outstanding leaders in the NGO community would get up and say how appropriate GM might benefit low-income countries. This is the wrong week to make this comment, but there are parallels with nuclear power; many environmental organisations have been strongly against, but some are seriously thinking about whether that it must be part of the solution on climate change.

Lord Giddens: Quite a few people in organisations have changed their views on nuclear power—until this week, anyway—like Stewart Brand. There has been a big shift of opinion among environmentalists—or there was, at least.

Q63I Baroness Parminter: Your report talks about the revitalisation of the extension services being fundamental to increasing levels of productivity. What are your views about what needs to change in the UK and the EU and are there any models that you are familiar with elsewhere in the world that would give us pointers on the way forward?

Professor Charles Godfray: The report argues that one needs not a reinvention of the extension service that we had 20 or 30 years ago, but a mixed-model extension service that has private components—it should be logical for food producers to pay for advice that increases their profit line—but also has a public component. We are increasingly going to require farmers and food producers to produce what are essentially public goods, such as reduced CO₂ emissions and seems logical that that type of advice should be paid for publicly.

I would also comment that how food producers operate, especially as you go down from the big mechanised businesses to the medium and small farmers, is immensely complicated and there is cultural inertias. It is not as easy as saying, “We will provide this advice, it will increase people’s income and so they will come and take it”. It is a more complex issue of increasing the social capital within the food producers community, which at the moment is highly variable. On the one hand there is a tradition going back to the 18th century of pioneering farmers who have carried out experiments to see how they can increase their farm’s productivity. On the other hand there are food producers who have extraordinarily low yields who farm, if you look naively from an economist’s point of view, in an illogical way. There can be a big cultural challenge to overcome there.

As part of the extension services, we should include not only the traditional agronomic skills and the new sustainability skills, but also increasingly farming as a business. There was always a component of that in the old extension services, but now, especially in a relatively high-income country such as ours, and particularly in the west of the country, a farmer's income will often not come 100% from food production; it will come from other activities as well.

I am not an expert in comparative extension services. In the report we had some interesting input from The Netherlands, whose farming system does differ somewhat from ours, but which has a more advanced extension. I have joint English and New Zealand citizenship. All my New Zealand family are farmers. They have a very innovative, largely privatised extension service. Forgive me, I am going more into anecdote than evidence now, but I get very strong positive responses from my relatives in New Zealand. I think the New Zealand Government is trying to add a greater publicly funded sustainability element.

Q632 Baroness Howarth of Breckland: Can I just ask a follow-up? We had a very good video session with the Americans. You would think that there was mainly privatisation in their extension services, and clearly there was a lot of that, but it became clear to us there was quite a lot of government funding, but it was very focused on where it went to ensure that the innovations were translated very clearly from the scientific community into the farming community. That seems to be what is happening in The Netherlands. As a concept, it is a better way of dealing with extension services, being utterly clear about the focus with public funding.

Professor Charles Godfray: Yes, and especially in the States and The Netherlands, they have extension services that are tied to state universities. It was built into the growth of the American university system and also, to a certain extent, in The Netherlands with Wageningen as a centre for crop science and Utrecht on the livestock side. That is such a radically different system from what we have here that I suspect that getting to it from where we are now would be difficult.

Our great research institutes, John Innes and Rothamsted, have been rather buffeted by changing political fashion over the last 30 years, when agricultural research has not been a top priority. At the moment they are trying to see themselves as the conduit from the basic research all the way through to the farm itself. We have a long way to go, but their ambition is exactly right.

From my sector—I should have said at the beginning that my day job is at the University of Oxford—there has been a steady diminution of agricultural research at the major universities, largely pushed by funding. Oxford used to have a Department of Soil Science, a Department of Agriculture and a Department of Agricultural Economics. It does not have them now. I used to be at Imperial College, which used to have agricultural research at Wye and does not now. I am worried by the loss not so much of the high-tech plant sciences, of which there are great research strengths at my university, at Cambridge and in other places, but the non-high-biotech part of research, which we need.

Q633 Baroness Howarth of Breckland: It is quite important that we hear evidence from you on how any system might benefit this progress. You say that it is quite difficult to see how the UK gets from where it is to where it might be, but we would like to look at the European context for what is going to be the most productive extension service to get those services moving forward from the lab to the farm.

Professor Charles Godfray: Of course it comes down to resources. Some of the money that goes through the CAP, which has moved from production subsidies towards different

types of support, could be channelled into innovation and extension. What is happening in the UK with the creation of different technology platforms as well as recent Research Council initiatives certainly helps. More broadly, BBSRC and INRA, its French equivalent, have a variety of programmes together and are extending them to include the other agricultural research powerhouses in the EU. It basically comes down to resources and this is a difficult financial climate to argue for more resources.

Q634 Lord Cameron of Dillington: It seems to me that agricultural extension has been forgotten about in this country and certain European countries. Some countries, such as Poland, are pretty hot on extension work. In the developing world the UK used to have a very good reputation for agricultural extension. I think we now have one extension officer in the whole of Africa. It has become pretty disastrous. It seems to me that if a scientist is working on any R&D project that is not going to be put on to the ground, it is a complete waste of their time and effort. If in the future any projects for R&D come for funding, every project ought to have written into it how the information or the results are going to be spread—probably not on to the ground because, as you rightly say, it is a question of doing research throughout the food chain on to the work floor. I wonder whether you agree. It seems to me that it is definitely in the hands of the scientists. They are the people who really understand what they are trying to achieve and the people who should be putting across the messages. Somehow, they have to devise their own ways of getting the information out there. Do you agree?

Professor Charles Godfray: I think that is right, but just to deconstruct that a little, what is required for innovation, especially if one is looking towards 2050, is a pipeline going from really basic research, such as how one can re-engineer the photosynthetic system of plants, all the way down to how you get nitrogen to the roots of the plants in such a way that less leaches away. If you take that spectrum, you ask different questions of people working at the different positions along the spectrum. It is a bit like a show garden at Chelsea. You do not judge it by any absolute criteria; you judge it by the criteria set by the individual aims of the designer. If you are trying to reconstruct photosynthesis, you should not be asked to say how this can help the farmer today. You are creating the fundamental knowledge that will enable something to be done in the future. When you get all the way down to saying that the reason why I am asking you to pay for this research is that it is going to improve efficiency on the farm, I would almost insist that there were farmers helping you to design the research right at the beginning.

Q635 Lord Cameron of Dillington: It is a pipeline, isn't it? Each stage of the pipeline must ensure that they know how the research they are doing is going to progress. I accept that generalised research on photosynthesis, or whatever it might be, need not go straight to a farmer, but they have to make sure that it is being progressed and it must be part of their remit to do so.

Professor Charles Godfray: That is right. I sit on the board of the Natural Environment Research Council. I worry a little bit that when we quite rightly ask anyone who receives public money for research to think about impact, the ways we ask them to at the moment are a little crude. They might hinder progress at one end of the pipeline where you really want the very smartest people doing things that are really innovative. If you move more towards research on applications, then I completely agree with you.

Q636 Lord Giddens: I think you have answered more or less all the questions that I am down to ask you in this category, but I will ask them anyway. If you feel that you should

Professor Charles Godfray: I have addressed quite a bit of that and I will not repeat what I have said, but I will comment on some of the general issues arising from your questions. The argument that the report makes most strongly—something that is already happening, so it is not as if we need to change course, but we have to reinforce it—is a rethinking about why we are investing in agricultural research. The issues of sustainability, which are coming more to the fore, really have to be emphasised. Most people get it. If you would have talked to someone like the chief executive of BBSRC 20 years ago he or she would have just talked about the importance of research into higher productivity. Doug Kell today takes a much more sophisticated approach emphasising production and efficiency.

Some of the greatest challenges are incentivising research into sustainability not only that paid for from the public purse, which is fairly responsive to policy decisions, but how one can get this into the private sector as well. When you talk to the major players in the private sector—the Syngentas and the Bayers—they often have a very sophisticated view. They look at their business model and they realise that the way in which they make most of their money at the moment is unlikely to be the same in 20 years. They are doing some really interesting things, especially in middle-income countries such as Brazil, not only in the big mechanised farms, but also in the medium and small enterprise farms, putting in the capital that allows smallholders to increase their yields. That has a direct benefit for the company involved, but is having all sorts of other societal benefits as well. It is about how one can take examples of best practice and spread them throughout the sector.

Q637 Lord Giddens: Should there be more research investigating structures of demand?

Professor Charles Godfray: Yes, absolutely.

Q638 Lord Giddens: How would that be organised? Most of our inquiry has concentrated, probably too much, on production and not enough on the impact of changing patterns of demand across the world for different types of food and other things around all that. What kind of research structure do you think might be put in place?

Professor Charles Godfray: Before I answer that question, can I say there are huge issues concerning even having a public discourse on demand. We have known for 60 years that cigarettes are a major health hazard, but it took 30 years before public opinion had moved enough to enable a genuine political discourse on it. You have written about equivalent things in climate change. There is very low public awareness of some of the issues on the demand side. It is impossible that we feed the 9.5 billion people who will be alive around the middle of the century if they consume meat at the rate that we in Europe do. Even if one moves from high-input beef farming into very efficient white meat, poultry and pigs, it is going to be impossible without major environmental consequences. We are not in a position yet where we can have a discourse about some of these really difficult issues of demand management.

On your specific question about research—I am a natural scientist rather than a social scientist—but I think there is a genuine lack of understanding about the behavioural psychology and the behavioural economics of individual people as they respond to the different options in front of them. These are important research questions in the social sciences.

Q639 Lord Giddens: Maybe there is a case for social and natural sciences working together on this issue. We know that there are strong elements of addictiveness involved in the changes of food taste and habits, stretching through from alcohol to fast foods. We have quite a lot of research data on all of that. The difficult thing for me is political. As I said before, we live in a world where corporations are introducing major changes in people's behaviour and have a vanguard effect on that, but they are not picking up the social costs of the changes that they are introducing. That includes the health system as well as the food system.

Professor Charles Godfray: We see this in microcosm in the States at the moment, with some of the big cities trying to bring in tax on sugary sodas and the response of the drink industry, so I agree with you. If I could just use your last comment to make a brief general point, in my world of academia we all talk about interdisciplinarity and we know that it is important, but it is extraordinarily difficult to achieve. I do not have the solution, but the challenges that we now face are very different from the challenges of 100 or 150 years ago when we were setting up our major research institutes, both universities and non-universities. If we were doing it again from scratch, we would do it in a very different way.

Q640 Lord Cameron of Dillington: Can I ask about science, turning away from the social sciences? You hinted at it earlier when you said that we were lacking in soil scientists, which is clearly a crucial part of this whole exercise. I suppose it is a bit like nuclear scientists. Nuclear was very unpopular and now, suddenly, there are very few nuclear scientists around. Is it the same in agriculture? Do we have the young scientists coming on in agriculture and the food chain generally?

Professor Charles Godfray: Soil science suffered for two reasons. First, in a time of food surpluses it was not a high priority. Secondly, it is a genuinely difficult science. The soil is almost literally a black box. The exciting thing is that there are a lot of new techniques that one can apply to it today—technological and conceptual techniques. You have probably come across the term systems biology, where you try to understand quantitatively the complex workings of the cell or the body. Exactly the same type of approach can increasingly be applied to the soil. I think it is intellectually really exciting – but we have very few soil science departments.

Q641 Lord Cameron of Dillington: Have you answered my question? Do we have the necessary young scientists coming on in all fields—not only soil, but a whole range of agricultural disciplines?

Professor Charles Godfray: Nuclear is an interesting example. I was 20 years at Imperial College. Manchester and Imperial kept their nuclear physics and nuclear engineering, almost gambling that it would come back again. I think it was a good gamble. Many big universities did not keep their agricultural research. My own university of Oxford used to have a soil science department. Now we do not have a soil scientist in the whole university.

Q642 Lord Cameron of Dillington: So there is a shortage of scientists?

Professor Charles Godfray: Yes.

Q643 The Chairman: Can I raise one question with you, which has arisen in our discussion. We have not had a satisfactory definition of what sustainable intensification means. Secondly, how far are new technologies intrinsic in any sense to sustainable intensification?

Professor Charles Godfray: On the definition first you can have a very simple but not very helpful definition of sustainability, which is just that you are using resources not in excess of the levels at which they are replenished. When you try to have a definition that can be used in a sensible operational way, then it gets really hard, because one has to consider both temporal and spatial components. Where do you draw the spatial or temporal boundary of sustainability? There is a difference in defining sustainability to be useful rather than aspirational. We had arguments with several people about whether the definition we used in the Foresight report, which we tried to make useful, should have been aspirational. We took the view, as can be applied to the extraction industries that you can temporarily use some resources that are unsustainable (water in aquifers for example) if you use the benefits to accrue to invest in future sustainable resource use (water efficiency for example). I can send you it if you are interested, but in the full report we have what we thought was the best definition of sustainable.

The Chairman: Yes, I have a copy of the full report. I am sorry. I had forgotten that you had done that.

Professor Charles Godfray: It is imperfect, but it is the best we could do at the time. If I could go off at a slight tangent, we talked a lot to the retail sector about how they can bring in more concepts of sustainability in the food chain. There is a real danger here of the perfect being the enemy of the good. They argued that if one can have definitions of sustainability that may not be perfect but which can be put in place across the industry to make a level playing field, and can be put in place for a sufficient period of time so that it is worth their while to invest in meeting them, one could make considerable progress. The report calls for trying to do this in the near future and leaving it in place, for perhaps 10 years, and then building on the best research to draw up new measures of sustainable food production.

Your second question was about intensification and sustainability. That is critical. There is a lot that we can do at the moment. We have talked about spreading best practice and extension, especially when one comes down to the major pinch points in competition for water and nutrients. The report argues strongly that to a good approximation there is no new land for food production. Given that we are certain that demand is going to increase, sustainable intensification is almost a deduction rather than an argument.

Q644 Baroness Howarth of Breckland: Going back a bit to social science, I want to talk about waste, which is about attitude as well as innovation and productivity. Your report says that “halving the total amount of food waste by 2050 is considered to be a realistic target ... if the current global estimate of 30% waste is assumed, then halving the total could reduce the food required by 2050 by an amount approximately equal to 25% of today’s production”. We would like you to say more about this, and why you believe that a cut of 50% in food waste by 2050 is realistic, bearing in mind some of the things we have talked about in relation to cultural change and behaviour. To what extent could the shortfall in production be addressed by reducing waste in the system as opposed to increasing agricultural productivity? We would like you to look at steps that could be taken in the UK and the EU.

Professor Charles Godfray: Just to take one of your final points first of all, what I hope we argue very strongly in the report is that food security is not just to do with production; it is also about demand modification and making the food system work more efficiently and dealing with waste. I hope the report is optimistic, but only if we approach all these things simultaneously. On whether the 50% reduction is realistic, we are going to get a bit of that for free as waste will decline if food prices rise. Our analysis and virtually all others suggests that food prices will go up over the next 20 or 30 years. There is a strong argument that a moderate increase in food prices might be a good thing (provided the every poor are protected from its effects) and what is critical is to avoid a catastrophic increase in food prices and greater volatility.

It is very hard to get data on the elasticity of waste with increasing prices. We do not know what it is. It is complex because there is also the cultural side. Our parents' generation were brought up in a way to minimise waste. Even if prices went up, many of the people today do not have the knowledge about food, or its preparation and storage that people had in the past. Again, cultural food literacy is very important.

It is also important to distinguish between waste in low-income and high-incomes countries. In low-income countries it is nearly all in the farm and in the food system. That needs targeted research (for example on better post-harvest storage) spreading best practice and investment in agriculture and the food system including in the rural economic system. A lot of food is wasted because farmers are so poor that as soon as they get a crop, they have to sell it; they cannot afford to store it until the market improves, so a lot of food is wasted in gluts. In countries such as ours, most of the food is wasted in the home and in the food service sector. There the issues are how one can incentivise that. There is an organisation called WRAP which has a very good summary of the different options that are potentially available in the UK. The Netherlands have a variety of pilot projects that involve an interesting mix of education, largely on increasing food literacy. The results of these will be coming through in the next few years which we hope will give us a better evidence base on waste on which we can act. I have been talking about traditional waste, but you can also talk about the new waste. No one would have considered the wheat stalks as waste in the past, but if one thinks about how that can be used, for example for producing power to address some of the climate change agenda, there are important opportunities for utilising this new type of waste. Forgive me, have I answered your questions?

Q645 Baroness Howarth of Breckland: Do you think more could be done by the corporate sector, in terms of the larger food outlets and restaurants and the areas where there is seen to be quite considerable waste?

Professor Charles Godfray: The corporate sector responds to market signals and is very efficient where it can be. An example of waste in the corporate sector is that that due to high cosmetic standards of food, for example. To a certain extent, that is consumer demand, but I suspect that is letting the supermarkets and other retailers off too lightly. It would be nice to see a major supermarket selling perfect apples, and then apples with specks at a slightly lower price. I am not sure of the economics of that. It might not be economic for them to do that, but it would be nice from the point of view of corporate social responsibility.

Q646 Lord Cameron of Dillington: On that last point, a better example is potatoes. Most people peel their potatoes, but the supermarkets insist on them having a perfect skin finish.

I wanted to talk about greenhouse gases. Your report talks about the need for better and more comprehensive metrics on greenhouse gas emissions, which I agree with. I wondered whether you could expand a bit on that and perhaps say who should be taking a lead in developing the metrics. As a sequitur to that, how do you think we can reduce greenhouse gas emissions on farms?

Professor Charles Godfray: We need better metrics in order to know what types of farming practice we should incentivise. I do not have to tell you that it is complex. Certain agricultural practices, such as no-till or minimum till, were thought 10 years ago to be an unremitting good. It is still probably good, but it is complex when you take in all the consequences, because of the difficulty of where you draw the lines where you are trying to evaluate the full ramifications of different practices.

I am quite optimistic about what we are doing in the UK at the moment. Defra and DECC have been very clear about how important this is. We have interesting research that is genuinely interdisciplinary. We are moving in the right direction on that.

A slightly broader point, as the report concludes, it is nonsensical for agriculture and food production to be outside the Kyoto and Copenhagen processes. Direct agricultural production accounts for 16%-odd of greenhouse gases. If you put in the food chain and land conversion due to agriculture it is up to 30%. It has to come in.

What can be done? Again, there are great opportunities for carbon sequestration on farms and improving carbon-use efficiency. There are issues of getting tilling right and recycling within farms. We have a range of things that can be done immediately. We need better metrics to judge what is best and then we need ways of incentivising it. I know this is part of CAP reform and thinking about how one can use some CAP money to incentivise emission reduction is critical. That needs to go further.

We also have to think much more radically about how we use the land. The report tries to argue strongly that the food security agenda is intimately tied up with all these other agendas. This will be very unpopular in some parts of the farming community, but there will be areas where it may make more sense to convert land to forestry or to permanent pasture. We should not be frightened of making those decisions and should then attend to how that can be done without causing the social disruption that is feared by the people who will be affected.

Q647 Lord Cameron of Dillington: If you take that argument to its logical conclusion, it would indicate that you are not looking at every individual farm. I have a view that all farms should have to have some standard metrics to measure what their greenhouse gas emissions should be. That would be a starting point, but someone needs to devise a standard method of measuring that on farms. Then you might get some sort of competition between farmers. What you are saying is that if you convert some farms because they are not particularly productive, they are using too much water, or some other reason, you should take a regional view of agriculture rather than a farm-by-farm view.

Professor Charles Godfray: I do. I think that applies to the ecosystem service that we have just talked about, carbon sequestration, but it applies very much to others such as biodiversity as well. There are complex trade-offs between whether you try to preserve biodiversity on farmland or you try to set aside land for biodiversity conservation. If you have a hungry global population, you are not going to be able to preserve biodiversity. The report is organised around five challenges to the food system and tries to argue on the last two challenges—feeding the world and maintaining ecosystem services; and feeding the

world and maintaining biodiversity—that one needs a more sophisticated, broader approach. In some cases, it really will make sense to maintain biodiversity on farmland. The wonderful agricultural systems in central Iberia around Extremadura have very high biodiversity and reasonable production. That makes sense. I have very little time for people who argue that we need 10% more ground beetles in the middle of a prairie in East Anglia. That is silly biodiversity. It makes far more sense to use that ground to produce food so that one can have some real biodiversity elsewhere.

Q648 The Chairman: Do you think that the pressure of price increases, which will increase the margin of cultivation, is going to create conflict between the demands for biodiversity and the demands for production?

Professor Charles Godfray: Yes. One of the reasons that it is going to be critical to address food security is not only the humanitarian agenda that we do not want people going hungry, but if we do not address food security, we will lose the Amazon rainforest and large areas of permanent pasture and we will lose the Congo basin forests. The consequences of that for greenhouse gas emissions and the climate regulatory role that those areas play are immense. The science here is not absolutely firm, but it is looking more and more that the whole climate system in South America would be disrupted by a major loss of Amazonian forest. The wonderful advances that Brazil has made in agricultural productivity could be put at threat if they lost the Amazon rainforest. This is work in progress in that area of science, but we have to get food security right, not only to feed people, but to address the major environmental challenges. And many of these critical issues around food security will happen in the next 10 or 20 years.

Q649 Baroness Byford: Thank you for your evidence and for your report. I have been off sick so I have not had a chance to read the full report, but I have gone through the summary very carefully. Following up on this being a global problem, are you giving presentations to, say, our economic Sub-Committee? To me the most essential thing here is that the world is able to feed itself. If we are not careful, agriculture will talk to itself, as it has in the past. Can I put that at the back of your mind?

Secondly, the *Reaping the Benefits* scientific report, which came out a year ago last December, was useful. Are there things in there that you disagree with? There may be aspects that you do not agree with, and I would be interested to hear about that.

Thirdly, and we touched on this earlier when we were talking about commodities, one of the biggest difficulties is surely the way in which we now do not produce just to sell to our local people; we are in a global commodity trading system. Did your report consider whether there was any alternative to commodity trading, which obviously has a huge effect not just on us as an individual country, but globally as well? I was not sure from the report whether it had considered that. Then I will come back to your proper questions.

Professor Charles Godfray: On the global impact, agriculture has not been seen to be the major engine of development that it was 50 or 60 years ago. In the period of the Washington consensus agricultural support was labelled as almost statist and interventionist. The report argues that this is wrong. Agriculture can be a really important engine of development. There is a triple benefit of development through agriculture. You are producing food; you are putting money into rural incomes and increasing the spread of income; and, especially in the lowest-income countries, - where most food is produced by women and other disadvantaged groups, you are directly getting resources to these groups that are hard to reach if you are, for example, investing only in building up industry. I know it

is not the main focus of your report, so I will not go into detail, but there is a lot in the report about food security and development.

John Beddington and I spent about half a week in Washington about three weeks ago, talking to the World Bank and to USAID. We have had a very good response from DfID, which is one of our co-sponsoring Ministries. There is a real renaissance of interest in agriculture in low-income countries.

You asked about the Royal Society report, *Reaping the Benefits*. Four members of my committee were on the committee of *Reaping the Benefits*, so it is not an independent comparison. We found that report hugely beneficial. David Baulcombe, who chaired it, did a fabulous job, and we have built a lot on it. There may be one or two technical things at the margin where we thought that X was more important than Y, and they held the reverse view, but they are really quite technical. That report looked wholly at crops and production. We took that as an area that we did not need to look into in great detail and then tried to build in the much broader questions of the food system.

Your final question was—

Q650 Baroness Byford: About international commodity trading and the impact that that has.

Professor Charles Godfray: As you are aware, there are different opinions in a country such as the UK about what the EU should do and whether a policy goal should be self-sufficiency and whether major policy goals should be to feed people locally. We commissioned quite a bit of research and reviews on that. Our conclusion is that neither should be a policy goal. If we were having this conversation in Singapore or Egypt, of course that would never come up. Countries like that have to import large amounts of food. Our conclusion is that the world is sufficiently globalised that it makes no sense to try to be self-sufficient. It could be very counterproductive. If one considers the type of regional production shocks that we are likely to get in the future, partly caused by climate change but partly caused by economic shocks or events such as the earthquake and tsunami tragedy that we are witnessing this week in Japan. A trade system that allows production in one region to compensate for losses in another is important. We do not think that feeding locally should be a policy priority in and of itself. Having said that, it may make a lot of sense to do that if it provides other benefits. We think that a policy of feeding locally should come out of other goals rather than being the prime mover.

Q651 Baroness Byford: Thank you for that. I will come to my last two points. Of the key priorities that you have given, the temptation must surely be to take the easy ones to achieve rather than looking at the overall more difficult ones. Choosing where the priorities lie is very difficult, but I wonder if you would like to have a stab at what your committee feels.

Professor Charles Godfray: To get it down to 12 from our initial list was painful enough! Essentially, quite a few of them boil down to sustainable intensification, on the production side. There is, to a good approximation, no new land. Whatever we do on demand management and waste—and we should do a lot on that—demand is going to increase dramatically over the next 40 years, so we have to produce more food. We now know that if we continue producing food the way we are at the moment, it will destroy our capacity to produce food. We have to do it sustainably. So sustainable intensification on the production side, and what that means in spreading best practice and investing in the new knowledge that we need, is the central thing that I would highlight.

Q652 Baroness Byford: Right. We are looking at what we do in the EU and the UK. A lot of the challenges that you have posed within this report need what I call big political decision. This is non-party.

Professor Charles Godfray: Yes, and political courage

Q653 Baroness Byford: Within our own country that is a challenge and within Europe it is a challenge. Globally, do you think it is realistic?

Professor Charles Godfray: I go back to the point I made earlier. Food and food security needs to rise up the political agenda. I am a biologist. It is hard to take oneself back 15 or 20 years, when climate change was the preserve of the academic community worrying away in a corner. We are far from having a perfect dialogue about climate change, but we have moved enormously in the past 15 years. One needs almost a parallel movement on food security. In some ways, food security should be easier, because I suspect that we are going to get more early-warning signals—we have already had the price shocks of the last few years—and things will be hitting our headlines faster than will happen in climate change, although the two are, of course, related.

The Chairman: Thank you very much indeed. This has been an extremely useful session for all of us. Thank you very much for coming along.

Department for Environment, Food and Rural Affairs (Defra)

Written evidence (IEUA 25)

SUMMARY

Defra takes a wide view in interpreting the concept of innovation, considering that it embraces both the successful exploitation by businesses of new ideas, techniques or technologies and, also, the wider exploitation of existing successful ideas, techniques or technologies for the benefit of individual agricultural businesses, the sector more widely, the environment and / or the broader economy and society. However, it is important to remember that innovation is not an end in itself but desirable only in terms of the benefits it can deliver in terms of higher productivity, the protection and enhancement of the natural environment, improved animal health and welfare and improved economic welfare / wellbeing. Innovation and technological progress are important factors underlying economic growth and improving productivity relies on adopting innovations associated with new technologies, products and improved working practices. The UK government encourages innovation through a number of routes, including working in partnership with other funders and industry to maximise contribution from R&D and technology transfer, aiming to help farm businesses help themselves in the uptake on new technology.

The impact of support under the Common Agricultural Policy (CAP) has meant that some farm sectors have tended to be insulated from market drivers over a period of many years and this is likely to have inhibited rather than fostered innovation. The low rate of business turnover historically within the sector is likely to have been exacerbated by the impact of CAP support with payments such as the Single Farm Payment tending to become capitalised in land values, and reflected in rents, increasing the cost of entry to those seeking to join the sector or to expand their businesses by acquiring more land. Defra believes that farms are best placed to innovate when they are driven by the requirements of the market, which can provide the appropriate signals with respect to production and investment decisions. Against this background, it is the UK government's ambition to reduce the burden of regulation on industry and to move away from basic income or price support, focussing the CAP on the delivery of public goods. Innovation, largely in the context of adopting tried and tested methods already being used by more successful businesses, can play an important role in this transition, helping to make businesses more sustainable in a competitive market. But there is no panacea or 'magic bullet': trying to force the sector to innovate is likely to be counterproductive as farmers are unlikely to wish to innovate unless they see clear benefits for their business and / or for themselves. Progress will require all stakeholders, including individual businesses, the wider food-chain, researchers and government, to work together with the emphasis on enabling farmers (and farming industry) to help themselves in adopting innovation and spreading best practice.

Introduction

Defra welcomes the House of Lords European Union Committee inquiry through its Agriculture, Fisheries and Environment Sub-Committee into innovation in EU agriculture.

Technology and innovation has a key role to play in addressing the global food security challenges arising from current trends in population growth, food demand, resource scarcity and climate change and the environmental impact of the growth in global agricultural

production. Defra is working in partnership with other bodies including, public funders, agri-food industry, EU and internationally to encourage innovation through R&D, education and skills development to support translation of research into practice. The response also considers the demographic structure of the sector, the future challenges driving innovation forward, the role of the Common Agriculture Policy and knowledge and innovation systems.

Defra has focussed its written evidence on the questions posed by the Committee.

Responses to the questions raised in the House of Lords inquiry

I. We have outlined above how we currently perceive “innovation” in the agricultural context, but we would welcome views on your interpretation of innovation in the agricultural sector.

- I) The concept of innovation has been interpreted in a number of ways but, at its simplest, it might be described as anything novel that adds value to the end-user or society. It is important to remember that innovation is not an end in itself but desirable only in terms of the benefits it can deliver in terms of higher productivity, the protection and enhancement of the natural environment, improved animal health and welfare and improved economic welfare / wellbeing. With respect to the farming sector in England and against the background of Defra’s Structural Reform Plan priority of supporting and developing British farming and encouraging sustainable food production, innovation is probably best characterised as follows: the successful exploitation by businesses of new ideas, techniques or technologies and, also, the wider exploitation of existing successful ideas, techniques or technologies for the benefit of individual agricultural businesses, the sector more widely, the environment and / or the broader economy and society. At the level of the individual farm business innovation may simply involve the adoption of better practices that other businesses have employed for some time as well as new products coming onto the market for, example, improved diagnostic tests and better methods to control disease in livestock, better crop varieties, crop protection and precision applications. Thus part of stimulating innovation may involve reducing the time between adoption by first movers and by followers within the industry (both within and across national boundaries). Innovation is key to the agri-food industry and encompasses the whole food chain from farm to food processing including, innovation in marketing and supply chain organisation and arrangement.

Innovation in EU agriculture as a strategic objective

2. The EU believes that innovation and knowledge are key to the EU’s economic growth and that all sectors should play their part. Do you agree that innovation in EU agriculture should therefore be pro-actively encouraged? Alternatively, do you see agriculture as a distinct sector faced with particular challenges to which the sector will inevitably react in an innovative manner?

- I) As has been noted in a number of studies⁴⁶, innovation and technological progress are important factors underlying economic growth and improving productivity relies

⁴⁶ For example: Griffith, Redding and Van Reenan: Mapping the two faces of R&D: productivity growth in a panel of OECD industries. *CEPR D.P. no. 2457*, 2000; Griliches, Zvi: The Search for R&D Spillovers. *Scandinavian Journal of Economics*, 94, p. 24-47, 1992; Griliches, Zvi: R&D and Productivity: the econometric evidence. *Chicago University Press*, 1994.

on adopting innovations associated with new technologies, products and improved working practices. Farming is no exception to this and the UK government is encouraging innovation through public investment in for example, the Technology Strategy Board (TSB)-led Sustainable Agriculture and Food (SAF) Innovation Platform and Knowledge Transfer Networks (KTNs) and the National Non-Food Crop Centre (NNFCC). The rationale for this lies in helping farm businesses to help themselves in the uptake on new technology, that they might otherwise shun through risk aversion or simply not be aware of as a result of information failures with respect to the existence or potential benefits of new technology. There is also a disincentive for individual businesses (especially small businesses) to invest in R&D because of high risks and difficulty of preventing benefits spilling over to other businesses. In a competitive market the benefits also tend to get passed through to the consumer fairly quickly, largely in form of lower prices, rather than remaining with the business. The government also has a particular role with respect to fostering innovation through creating an appropriate regulatory environment that serves to encourage rather than impede the spread of best practice and the take up of innovation by the industry.

- 2) Similar to other sectors, comparisons of the productivity performance of farm businesses in the UK indicates a wide distribution of performance with significant scope to improve performance overall on the basis of existing technologies and practices. Research evidence (*Farm Business Management Practices in England, Statistical Notice Defra 2010*) indicates that these differences in performance are driven by a combination of factors but that, amongst these, skills and business organisation are important. Unlike many other sectors of the economy, farming is essentially an industry characterised by a large number of small businesses, largely unincorporated and run as partnerships or sole proprietorships. At June 2008 there were estimated to be some 328 thousand agricultural holdings in the UK. Their distribution is very skewed with a relatively small proportion of farms accounting for the overwhelming majority of the sector's output and its value added. A reasonable approximation is that around 20% of registered farm holdings account for about 80% of output / value added and that more than half of output / value added is provided by well under 10% of farms. Thus, in considering the adoption and uptake of innovation within the sector, greatest attention should be directed towards those farms that account for the lion's share of output as efforts can be focused on a relatively small proportion of the sector and any impact on the efficiency with which these relatively few farms convert inputs into output will be reflected to a large degree at the sector level. Even if the adoption of some innovation meant that output could be instantaneously doubled for the smallest 50% of farms with no change in their inputs, the impact on the productivity of the sector overall would be quite modest. This does not imply that these smaller farms should be ignored but that the focus should be on stimulating innovation on those farms capable of delivering the biggest economic and environmental performance gains and of embedding new techniques and practices. These can then be more readily adopted, by demonstration of successful impact, by the less dynamic or smaller farms.
- 3) There are a number of challenges that will drive innovation in the agricultural sector. These are explored in more detail in Q6.

Innovation today

3. How is EU agriculture innovating now? Can you explain under what conditions the agricultural sector is best placed to innovate? Do you have examples of circumstances where innovation would have been possible and would have been helpful, but did not occur?

1. As noted above, the agricultural sector comprises a large number of, mainly, relatively small businesses. It is therefore difficult – and can be misleading – to generalise about how the sector is innovating. Responses will inevitably vary across the farming community, according to behavioural drivers, with different businesses in the farming sector reacting in different ways to any given set of economic and environmental challenges: some will respond in an innovative manner, for example through the adoption of precision farming techniques to reduce costs and environmental impacts, while others will attempt to carry on without making any – or only the minimum of - changes. However, innovation and technological progress represents one of the major drivers of improved productivity, providing opportunities for businesses to raise their relative performance by being an early mover. New ways of working can provide a source of efficiency gains, enabling workers to operate more effectively and providing businesses with greater opportunities to use their resources in ways which maximise their productive potential.
2. The impact of support under the Common Agricultural Policy has meant that some farm sectors have tended to be insulated from market drivers over a period of many years and this is likely to have inhibited rather than fostered innovation. Arguably, farms are best placed to innovate when they are driven by the requirements of the market, which can provide the appropriate signals with respect to production and investment decisions. Against this background, it is the UK government's ambition to reduce the burden of regulation on industry and to move away from basic income or price support (Pillar 1), focussing CAP on the delivery of public goods (Pillar 2), particularly for protecting and enhancing the environment, and to help the sector increase its competitiveness in a market driven environment. Innovation, largely in the context of adopting tried and tested methods already being used by more successful businesses, can play an important role in this transition, helping to make businesses more sustainable in an open market.
3. With respect to missed innovation opportunities, it is difficult to demonstrate the impact of something that might have happened but didn't. However, in order to increase food production sustainably, innovation in agriculture has as much – or more - to do with spreading existing best practice across a greater number of farms than with the adoption of new techniques and practices by the leading businesses, though this is still important. Recent research into productivity⁴⁷ has shown that for the UK and other Member States and for each farming sector, there are some farms at the 'frontier' of efficiency, followed by the rest at various distances from the frontier. The key steps must be to foster an economic and policy framework that enables (i) the efficiency frontier to carry on moving forwards via innovation, with early adopters remaining at the leading edge, and (ii) the remaining farms to get closer to the frontier via the adoption of best practice. Hence, innovation is likely to be accelerated through measures that encourage the spread of best practice, such as

⁴⁷ A Report on Agricultural Efficiency at the Farm Level 1989 to 2008, Scottish Agricultural College, June 2010

facilitating better self-assessment of individual relative economic performance via benchmarking against others, discussion groups, better knowledge of business management techniques. The basic rationale lies in helping farm businesses to help themselves through recognising how their performance compares with their peers and what areas they need to address to get the greatest gain. There would, however, appear to be a significant information failure in that the main reason claimed by farm businesses in England for not benchmarking performance was not having received any information on benchmarking. Benchmarking, of course, also requires farmers to have the relevant information available to them on their own farm's performance. Most farmers should have access to their financial accounts which are prepared for taxation purposes each year and these can be used for some basic benchmarking at the whole-farm level against Farm Business Survey results for example, machinery costs, labour costs by farm type. More detailed benchmarking at enterprise level for example, milk, wheat, pigs, requires enterprise-specific data and not all farmers will have this material, or at least in much depth.

Obstacles to innovation

4. What are the current obstacles to innovation? Is there a shortfall in research capacity and in technology transfer? To what extent do issues such as intellectual property rules, resistance to new ideas, inertia, fear of failure and lack of communication block innovation in the agricultural sector? What are the obstacles to land managers incorporating forestry into their businesses?

1. *With respect to R&D itself*, the TSB Platform on agri-food is driving innovation through collaborative ventures between industry and academia. A 'lessons learnt' review of the Platform's first call on crop protection being undertaken by TSB will explore opportunities for simplification to encourage innovation in the agri-food sector. The Government will consult with business in autumn 2010 to review the taxation of intellectual property, R&D tax credit support for innovation and the proposals of the Dyson Review to boost innovation in Britain in all sectors including agriculture.
2. *With regards to any shortfall in research capacity and in technology transfer*, a recent report from BBSRC/HEFCE on land based facilities and Defra's Capability review both commented on the current UK capabilities in agriculture. Neither report identified a significant current lack of capacity, but they did recognise the significant contribution of government funded research institutes, especially BBSRC institutes, and the risks associated with any future reduction in funding to these strategically important institutes. There may also be scope for establishing Centres of Excellence to consolidate scientific expertise to support the agricultural sector.
3. The UK Cross Government Food Research and Innovation Strategy⁴⁸ published in 2010 provides a coherent framework to facilitate a more co-ordinated and collaborative approach between public sector bodies involved in funding, commissioning and delivering research in the UK. To implement this Strategy, Government Departments, public funders, industry and academics work together through the Food Research Partnership, chaired by the Government Chief

⁴⁸ <http://www.bis.gov.uk/assets/biscore/goscience/docs/c/cross-government-food-research-strategy.pdf>

Scientific Adviser, to consider research skills, research capacity and translation/exploitation of research and how these can be addressed to maintain agricultural research and innovation in the context of the challenges posed by food security and climate change.

4. To support these activities Defra and the BBSRC are funding a major study on the flows of knowledge and research through agri-food sectors in order to develop qualitative and quantitative data on which an analysis of the issues in knowledge exchange and research translation can be based. This study focuses on wheat, a major UK crop, used in many different industries including food, animal feed-stocks, and bio energy. Related studies have been initiated with the Scottish Agriculture College in dairy, and the National Horticulture Forum in horticulture.
5. *With regards to the take up of innovation at business level*, individual farmers and landowners (and to some extent family farming partnerships) are primarily individuals and in many respects will tend to behave very much like other individual decision-makers. In this respect, and as noted above, they will tend to differ amongst themselves in the nature and speed of their responses to the possibilities offered by the adoption of innovative technologies or practices. Relatively few early adopters or innovators are likely to be followed by an increasing pace of take-up as 'mainstreaming' occurs with the pace then slowing again with the later adopters who may be more cautious or who have other external or internal barriers. There is also likely to be a transition at the individual decision-making level, starting with initial awareness of an innovation leading to thinking about its adoption, and finally, seeing it through to realisation – or, possibly, being discounted as uneconomic or impractical. An initial idea about, say, buying a large piece of capital equipment or adopting precision farming technique may develop momentum through reading the press, listening to peers, and getting advice (building up knowledge and confidence) which expedites the change leading eventually to productivity benefits.
6. *At farm level*, obstacles to the adoption of innovative practices among farmers can be categorized as external, internal or normative.⁴⁹ External barriers often relate to the costs of implementing the specific action (which is linked to the farmer's perception of the potential return on investment). Costs may be financial or relate to time/human resource. However, it should be noted that despite the 'credit crunch', credit availability for UK agriculture has not been a problem for the vast majority of businesses. Internal barriers relate to farmers' attitude and their evaluation of whether any given innovation will be effective. That is, will the practice yield a sufficient return, within the context of their specific farm within a suitable time-scale. Farmers may fail to adopt innovations that have a good chance of being profitable. This can result from risk aversion arising from the possibility that the investment may not deliver a worthwhile return or simply as a result of information failures and a lack of awareness of the potential benefits of some new technology. Farmers are also likely to adopt practices which have been adopted/which are advocated by key social contacts such as other farmers, friends or trusted advisors (e.g. consultants, agronomists). Working with the industry to exemplify demonstration farms will also have a role here. Defra's research into the drivers and categorisation of farmers'

⁴⁹[http://www.defra.gov.uk/evidence/statistics/foodfarm/enviro/observatory/research/documents/ACEO%20Behaviours%20Discussion%20Paper%20\(new%20links\).pdf](http://www.defra.gov.uk/evidence/statistics/foodfarm/enviro/observatory/research/documents/ACEO%20Behaviours%20Discussion%20Paper%20(new%20links).pdf)

attitudes and perceptions informs understanding of behavioural obstacles. Understanding what motivates and underpins decisions can help to build partnership approaches between farmers and key delivery partners and encourage the take up of voluntary initiatives.

Demographic structure of the sector

5. To what extent is the demographic structure of the sector (an ageing farming population) an obstacle to innovation; and, conversely, might greater innovation in agriculture serve to bring new recruits to the sector? What incentives currently exist to encourage young people to agriculture; what further efforts might be made?

1. Historically, there has been a low rate of business turnover within the sector with relatively few businesses entering or leaving. This is likely to have been exacerbated by the impact of CAP support with, for example, payments such as the Single Farm Payment tending to become capitalised in land values, and reflected in rents, increasing the cost of entry to those seeking to join the sector or to expand their businesses by acquiring more land. However, the Royal Institution of Chartered Surveyors (RICS) reports in its latest assessment of the farmland market⁵⁰ that commercial farmers are keen to expand production, particularly onto neighbouring farms, and are willing to pay a premium to do so. Also in a recent research report commissioned by Defra⁵¹, the researchers noted that, despite the very low level of land being sold, the farming sector has undergone a period of considerable consolidation with the average business size continuing to rise. This has occurred through various arrangements that allow the 'farmer' to remain on the holding, but the agricultural activity be managed by someone else.
2. A range of current government supported activities aim to help encourage new recruits into agriculture and educate young people about farming. Defra initiated the development of the Agri-skills Strategy bringing together key industry players (NFU, Lantra, Landex and AHDB). The Strategy seeks to embed skills development into everyday business practice and establish a recognised career structure through continuing professional development (CPD), making the industry new starters. In addition, Defra provides financial support to Fresh Start and the National Federation of Young Farmers Clubs and payments to farmers who provide educational visits to their farms from schools as part of their agri-environment scheme agreements. Other government departments such as BIS and DfE also provide Diploma for young people and apprenticeships to encourage new entrants to the farming industry.
3. Research (ADAS 2004) has found that the majority of those entering farming do so through the family farm. The most common reason given for the low rate of entry to farming was the expectation of relatively low incomes. As discussed in Q3, this can only be addressed by developing a competitive, viable and sustainable farming sector that is more attractive to potential new entrants.

⁵⁰ RICS Rural Market SurveyH1 2010 (<http://www.rics.org/ruralmarketsurvey>)

⁵¹ [Impacts of Changes In The Wider Economy On Agriculture And The Agri-Environment](http://www.defra.gov.uk/evidence/statistics/foodfarm/enviro/observatory/research/documents/agriculture-wider-economy.pdf)
<http://www.defra.gov.uk/evidence/statistics/foodfarm/enviro/observatory/research/documents/agriculture-wider-economy.pdf>

Future challenges driving innovation forward

6. Looking forward, agriculture faces significant challenges, although those challenges may bring opportunities too. What challenges do you think will drive forward innovation in EU agriculture in the future? What do you think should be the responses to these challenges, and who would you expect to deliver these responses?

1. Technology and innovation has a key role to play in addressing the global food security challenges arising from current trends in population growth, food demand, resource scarcity and climate change and the unsustainable environmental impact of the growth in global agricultural production.⁵² R&D on crop improvement generally, through breeding, husbandry and crop protection will help address the challenges. Crop breeding, supported by technological advances (including, in time, Genetic modification), can make a significant contribution to e.g. durable host plant resistance to crop diseases and pests to reduce the dependence on pesticides and allow development of integrated pest management (IPM) approaches, also utilising biological control methods and more targeted use of lower pesticide doses.
2. Amongst the specific challenges facing the agricultural sector there are likely to be those arising from:
3. An expected increase in demand for food due to population and income growth, and increased competition for natural resources, such as energy sources and fertilisers, which raise concerns about food security.
4. An evolving institutional environment, influenced by factors such as ongoing reform of the CAP and changing support.
5. An evolving physical environment reflects agriculture's substantial environmental impact with particular challenges likely to arise from, climate change and the need for adaptation and mitigation measures while reducing negative impacts on biodiversity, water quality etc. Defra's written evidence to the House of Lords EU Committee's (Sub Committee D) inquiry into 'Adapting to Climate Change: EU Agriculture and Forestry' addresses the likely impacts of climate change on agriculture, including the impacts on soil through drought and erosion due to heavier rains, an increase in crop pests and diseases and animal diseases. As well as threats, climate change offers new opportunities for farmers such as longer growing seasons and opportunities for new crops. Farmers and land managers will need to innovate to mitigate the threats and make the most of the opportunities.
6. Meeting these challenges will require a multipronged approach to improving production systems, which was highlighted in the Royal Society Report ⁷ and is likely to involve a partnership approach involving all relevant stakeholders, including the research community, the farming sector and wider food-chain, individual businesses and government. R&D and Innovation will play an important role by, for example, providing the tools and knowledge to help ensure water and nutrients are used more effectively by crops and animals, thereby reducing total inputs to the system, optimising outputs of food, fuel and materials and reducing greenhouse gas emissions

⁵² The Royal Society Report "Reaping the benefits: Science and the sustainable intensification of global agriculture"
<http://royalsociety.org/Reapingthebenefits/>

and other negative impacts on the environment. In this context, there will be a need to consider any potential complementarities or trade-offs between environmental and economic outcomes, seeking to exploit opportunities to deliver on both through, for example, more efficient use of inputs driving down costs while, simultaneously, reducing environmental externalities. Benefits from this investment should be shared with the industry as benefits are both public (improved environmental sustainability) and private (in terms of increased business sustainability). The Foresight Project on Global Food and Farming Futures, led by the Government's Chief Scientific Advisor Sir John Beddington, is assessing how farming can meet an increase in food demand sustainably by 2050.

7. Defra's Evidence Investment Strategy⁵³ considers the prioritisation of research investment in the context of these challenges and through research partnership agreements with other funders, including Living with Environmental Change (LWEC), the Global Food Security Programme, TSB Agri-Food Platform and the UK cross-Government Food Research and Innovation Strategy. Defra's EU and international collaborations include, the Joint (research) Programming Initiatives (JPI), ERA-Net (for example, Plant Health Research), the Global Green House Gas Research Alliance and the newly approved Global Strategic Alliances for Research on Major Infectious Diseases of Animals and Zoonoses.
8. To support private sector investment, application and translation of research into practice, Defra's R&D and innovation activities include:
 - the Crop Genetic Improvement Networks (GINs) that are working to improve the environmental footprint of UK farming through greater understanding of genetics whilst ensuring all relevant research information/findings are shared and are incorporated into the UK breeding programmes;
 - Collaborative R&D with industry e.g. GPS mapping, remote sensing, sampling, data collection and automation to support 'precision farming';
 - development of improved decision tools for use by farmers and advisors;
 - development of the integrated control of pests, diseases and weeds (IPM) in the main arable, vegetable, fruit and protected crops to reduce use and environmental impacts from pesticides;
 - UK Climate Impacts Programme to provide tools to assist decision makers to assess and manage the risks of climate change and underpin R&D to help farmers.
 - Collaborative funded research with industry through LINK and the TSB SAF Innovation Platform is informing knowledge on reducing emissions and pollutions from livestock systems, drought tolerance of crops, effect of climate change on wheat yields and challenges posed by the impacts of climate change on new pests and diseases of crops and livestock.
 - The Demonstration Test Catchments project is working directly with farmers to develop and demonstrate improved farming methods with reduced impacts on water resources.

⁵³ <http://www.defra.gov.uk/evidence/science/how/documents/eis-100126.pdf>

Knowledge and innovation systems

7. Analysts have suggested in the past that innovation is best served by co-ordinated formal and informal systems of researchers, consumers, producers, retailers, advisers and government. What sort of systems do you think are required to support innovation in EU agriculture?

1. There is no panacea or ‘magic bullet’ and it is likely to be counterproductive to try to force the sector to innovate: as noted above, innovation is not an end in itself and farmers are unlikely to wish to innovate unless they see clear benefits for their business and / or themselves. Progress will require all stakeholders, including individual businesses, the food-chain as a whole, researchers and government, to work together with the emphasis on enabling farmers (and farming industry) to help themselves in adopting innovation and spreading best practice. And similarly for individual farm businesses, there will often need to be a series of smaller innovative actions to improve their performance, and it will be the sum of these smaller actions which add up to make a significant difference (as an analogy consider the British Olympic Cycling team’s pursuit of the aggregation of marginal gains which was all about getting all the small things right which together made them the most competitive cycling team in Beijing). Key example of partnership working is provided by the Technology Strategy Board co-funding with Defra and the Biotechnology and Biological Sciences Research Council (BBSRC) to bring together a major initiative to stimulate the development of new technologies that will increase food productivity, while decreasing the environmental impact of the food and farming industries. To help farmers take up new sustainable technologies, the Sustainable Agriculture and Food (SAF) Innovation Platform envisages investment of up to £90 million over the next five years in innovative technological research and development in areas such as crop productivity, sustainable livestock production, waste reduction and management, and greenhouse gas reduction.
2. As discussed earlier, there is considerable scope to expand the use of benchmarking against others within the sector so that farm businesses have a greater understanding of their relative performance – and areas of underperformance where there is scope for them to innovate. Benchmarking also holds the possibility that farmers will be able to improve their environmental performance through being able to identify where there is scope for them to make a more efficient use of inputs, thereby reducing e.g. pollution to water and air and reducing GHG emissions etc – though this in itself would represent something of an innovation. The demand for benchmarking based on Defra’s Farm Business Survey (FBS) implies an appetite and belief in efficacy amongst participating farmers, although it should be remembered that at present only around a quarter of farms in England regularly benchmark their performance against their peers.

Research and Development

8. Assuming that R&D has a role to play as part of knowledge and innovation systems, how should the research agenda be established in the field of agriculture? How should such research be funded, particularly in the light of budget cuts driven by austerity measures?

1. The Government Chief Scientist’s Food Research and Innovation Strategy was published at the beginning of 2010, which is fully supported by Defra. It provides a coherent framework to maximise the contribution from research and innovation and

collaboration between funders and key stakeholders through development and dissemination of new knowledge, technology and skills. This was published alongside the Food Strategy ("Food 2030") which sets out a vision for a secure and sustainable food system and supports delivery of these goals.

2. Defra's Evidence Investment Strategy sets out how the Department will prioritise and fund agricultural research against the constraints of public expenditure. In deciding its priorities Defra works in partnership with other government departments, Research Councils, Devolved administrations (for example, through joint research programmes e.g. the Global Food Security Programme, LWEC) and at EU level via EU Framework Programmes and internationally. This joined up approach to tackle these global challenges on agriculture and food is closely aligned with the research framework set out in the GCSA's Food Research and Innovation Strategy.
3. Industry has a critical part to play in informing Government of sectoral priorities and in taking forward research outputs into practical application. For example, the industry-led Fruit and Vegetables Task Force set up by Defra helped inform priorities. Co-funded research can also be used to underpin new product, processes or systems development. The major retailers, small-medium sized enterprises (SMEs), levy bodies, farmers, consumers and all other stakeholders in the agriculture supply chain have a role in this. As noted in Q7, Defra is making a contribution to the TSB SAF Innovation Platform which is a key vehicle for delivering value for money through involving private investment in funding agriculture research programmes to support translation of research.

Education and skills

9. What is the current state of education and skills provision relating to agricultural research, the agricultural sector and advisory services? How might such provision be enhanced?

1. A recent cross-government report "High-level skills for food" led by the Government Office for Science identified that there has not been a decrease in the number of agricultural students, but there appears to be a lack of demand from industry for high-level skills at graduate level (level 4 and above).
2. The loss of specialist skills in the HEI sector which are required to underpin important challenges such as food-security, climate change and an ageing population is always a concern for Government, and a particular risk when these skills are in niche areas with limited UK expertise. In 2009 BBSRC, in collaboration with the Bioscience Federation, launched a niche skills consultation to address concerns over potential shortages in strategically important and vulnerable niche areas of research expertise, including those in agriculture which received most responses.⁵⁴ BBSRC has now identified plant and agricultural science as an important future priority for skills and training.
3. The Year of Food and Farming (2007), was an industry led initiative which helped to raise the profile of food and farming related activities in the school curriculum

⁵⁴ <http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905-bioscience-research-skills.aspx>.

considerably. This continues in the legacy programme “Think Food and Farming” led by FACE (Farming and Countryside Education). FACE is a charitable body established to promote farming and countryside activities in the curriculum and a key provider of curriculum resources to teachers. Defra also supports farmers to provide educational visits for schools as part of their agri-environment schemes.

4. A key potential source of provision for young people is the recent DfE led Diploma in Environmental and Land Based Studies. However, this has only recently started up and will need to be rolled out considerably more widely before it has any real impact.
5. In addition, there are apprenticeships in agriculture supported by BIS and again promoted by Lantra. There is currently very low take-up of agricultural apprenticeships. One reason is the difficulty for individual farm businesses, which are often small and fairly specialised, to offer the range and depth of work experience required to support the college training. In some areas this has been overcome by using consortia of farmers who share trainees to maximise the breadth of work experience.
6. The land based college network provides a wide range of agricultural and related training for all ages from about 14 years upwards. These range from the diplomas and apprenticeships mentioned above, as well as National Vocational Qualifications (NVQs), and various levels of qualification up to full degrees. In addition, Higher Education (HE) colleges also provide some land based courses as do a limited number of Universities. The new *BBSRC advanced training programme in Agri-food enables specialist agricultural higher education institutions, employers, levy bodies, trade associations, research funders, universities and research institutes to work in partnership to ensure that the right expertise, high and very high-level skills (post-graduates) needed by this sector are developed in collaboration.*
7. Generally the sector would appear to be well provided for. Issues include; the complexity of provision and multiple sources of information about schemes and funding, accessibility to learning with travel times to learning centres often being relatively long, as well as low demand for agricultural skills, though there are signs that this has been improving recently. There is probably scope for enhancing provision to support key Defra priorities for farming such as climate change adaptation and mitigation, nutrient management etc as well as improving transferability of R&D into general farming practice through college education.

Knowledge transfer

10. How should research be translated into technology transfer and advice to practitioners? What are the respective roles, for example, of professional advisers, professional organisations, peer groups and the public sector?

1. A large number of bodies and organisations (e.g. research councils, other government departments including Defra, the EU framework programmes) work together in the agricultural R&D/KT pipeline continuum to improve UK’s innovation performance. As outlined previously, examples of working with industry to meet evidence and KT needs include the TSB SAF Innovation Platform and the KTNs. The Agriculture and Horticulture Development Board also has a pivotal role to improve

the efficiency and competitiveness of the agriculture and horticulture industries through KT arising from its own programme of applied R&D, demonstration and research projects funded in partnership with government, industry organisations and the EU. Knowledge resulting from R&D activities is translated into advice and delivered to farmers through schemes such as the England Catchment Sensitive Farming Delivery initiative.

2. Defra's experience in working with the Biosciences KTN identified a number of factors for the delivery of effective KT. These include the need for industry drive and involvement throughout the project whilst improving industry's capacity and capability to take up project findings; need to ensure existing research is suitably disseminated on a continuing basis, particularly if the results are not immediately ready for industry uptake; in evaluating projects, evidence of benefits to users and demonstrated industry commitment are required together with a roadmap or business plan of how the technology will be applied; lack of specialist KT personnel together with the funding and development gap between the end of a project and a usable technology limiting project success; a need for better use of existing people such as consultants, sales people etc who have contact with end users; equal involvement and interest from industry and academia are key to the success of projects and academics need to be incentivised to have more involvement in applied science and KT activities.
3. DEFRA has commissioned a number of studies looking at the most effective way of advising farmers/influencing farmers' behaviour. Some common findings about communicating advice to farmers emerging from these studies revealed that communicating complex information in writing is often ineffective; farmers are generally more likely to take advice from local, trusted sources, that don't have an 'alternative agenda'; formal collective events are well-liked by most who attend but tend to self-select the most interested and innovative farmers. In general, these study findings suggest that farmers are less likely to act on advice from the government than that from industry representatives or peers. This evidence suggests that knowledge transfer is best achieved by working in partnership with professional advisers, professional organisations and peer groups.
4. There are many practical examples of where knowledge transfer from research is best delivered in partnership with the public sector delivery network as well as with professional advisors and industry groups. Industry based initiatives, supported by government, and cross-sector collaborative initiatives can also be useful ways of bringing together expertise. An example of this is the "Tried and Tested" initiative which was developed in partnership with 5 industry representative bodies (AIC, FWAG, LEAF, NFU and CLA). Defra commissioned research which provided web-based planning tools and detailed guidance for innovation while the industry promoted innovation by using their existing advice networks to disseminate the information in a practical way to farmer groups. The effectiveness of such initiatives is enhanced when they incorporate farmers' own knowledge and perspectives.
5. There is also significant evidence to suggest that farmers will take-up informal advice from other non-industry sources – for example local vets or accountants (where financial decisions are involved). Evidence on the success of farmer networks and local peer to peer transition is mixed and the value of such knowledge transfer is

likely to vary for different types of farming enterprise and for individual farmers. Although some farmers have noted benefiting from attending peer meetings when such meetings have been organised, others, most notably smaller livestock enterprises, lack time to regularly attend such events.

6. Demonstration farms can also have a role on knowledge transfer. There are already a number of demonstration farms funded by both the public and private sector, such as the LEAF network of demonstration farms and the beacon farms being set up under the Campaign for the Farmed Environment allow for new techniques, products and technologies to be tried, tested and showcased. There is impetus to build on the existing network of demonstration farms to showcase new techniques, products and technologies, and a need to assess the potential for these networks to deliver requirements set out in the Taylor Review⁵⁵ in terms of encouraging greater use of the network to improve productivity.
7. It should be noted that farmers are being provided advice on an ever increasing array of topics through a wide range of channels. The complexity of this advice network can make it difficult for farmers to navigate, and there will be a need to ensure that formal advice in particular is co-ordinated and simplified as much as possible to improve its accessibility to farmers.

EU Policies

11. What are the roles of the Common Agricultural Policy and EU research policy, including the Framework Programme for Research and Development, in helping to resolve the issues highlighted above? Where public intervention is desirable, what is best done at a lower level of governance?

1. As noted in Q3, farm businesses are best placed to innovate when they are driven by the requirements of the market, which can provide them with the appropriate signals to inform their production and investment decisions. However, the impact of support under the Common Agricultural Policy has meant that, over a period of many years, some farm sectors have tended to be insulated from these market drivers, tending to inhibit rather than foster innovation. Future reform of the CAP with a move towards measures directed towards the delivery of environmental goods and services or with helping the sector become more competitive, is therefore likely to be more conducive to innovation and the adoption of best practice.
2. Measures currently available under Axis 1 Pillar 2 of the CAP are aimed at improving the competitiveness of the agriculture and forestry sectors and, within this, innovation and KT can potentially be facilitated through funding for vocational training and information. Additionally, measure 124, which supports collaborative actions amongst individual farmers and between the industry and its market, along with associated research and development, is intended to promote the efficient take-up of new products, processes and technologies, thereby helping to address problems that farmers might have in accessing the relevant information on the possibilities open to them.

⁵⁵http://www.conservatives.com/News/News_stories/2010/09/Conservatives_announce_recommendations_of_Taylor_Review.aspx

3. With respect to EU research policy, the Framework Programme is the main Community mechanism for funding collaborative research in the “European Research Area”, aiming to provide evidence to underpin EU policy development and to strengthen EU competitiveness. The current seventh iteration (FP7) supports research for agriculture primarily through the “Food, Agriculture and Fisheries, and Biotechnology” (FAFB) theme.
4. As with nationally funded R&D, FP7 has a role to play in providing a knowledge base for innovation. FP7 also funds projects and actions that support knowledge dissemination. For example, a European-wide “Knowledge Transfer Promotion Scheme” is to be established which will create platforms to encourage shared learning processes for the management and transfer of knowledge. The most recent FAFB work places a special emphasis on the dissemination and take-up of research results at the project level. It also supports innovation through increased participation of industry, aiming to spend 15% of the call budget on SMEs through their mandatory participation in designated topics.
5. Although FP7 has a role to play in the funding of R&D, it represents around 10% only of the research carried out in Europe: the bulk of knowledge generated is funded through national research programmes. FP7 can help to ensure that national programmes do not operate in isolation, providing funding to support coordination through the European Research Area Network (ERA-NET) mechanism, with several ERA-NETs operating in agricultural research areas. In the future, FP7 will also provide important support during the development of the Joint (research) Programming Initiatives (JPI) being established in Europe. The Food Security, Agriculture and Climate Change JPI, coordinated by France and the UK, will be seeking to develop and implement specific solutions to the major challenges being faced by agriculture, and the development of highly innovative breakthrough technologies in crop and livestock production.
6. Activities supported by FP7 are closely linked to those of the EU’s Standing Committee on Agricultural Research, which facilitates a range of collaborative activities to support the coordination of national research programmes. A Collaborative Working Group on Agriculture Knowledge and Innovation Systems (AKIS), led by The Netherlands and France, has recently been established to examine the strengths and weaknesses of the AKIS in Europe, the drivers and incentives for innovation, and to act as a starting point in establishing a European monitoring device for AKIS structures and their evolution.

September 2010

Oral evidence, 23 March 2011, Q 673-710

Evidence Session No. 21. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
Baroness Byford
The Earl of Caithness
Lord Cameron of Dillington
The Earl of Dundee
Lord Giddens
Baroness Howarth of Breckland
Baroness Parminter
Baroness Sharp of Guildford

Examination of Witnesses

Witnesses: **Jim Paice MP**, [Minister of State, Defra], and **Sue Popple**, [Deputy Director: Farming and food science and GM policy and regulation, Defra].

Q654 The Chairman: Mr Paice, good morning and welcome. It is nice to have you back. You were here in November talking to us about forestry.

Jim Paice MP: The least said about that the better, I think.

The Chairman: Just to deal with the formalities, this is a formal evidence-taking session of the Sub-Committee and a full transcript is being taken. That will go on the public record in printed form and on the parliamentary website. We will send you a copy of the transcript, which you will be able to revise for minor errors. The session is on the record and is being webcast live and will be subsequently available via the parliamentary website. For the record, could you state your name and position and then we will go to the first question.

Jim Paice MP: I am Jim Paice MP, the Minister of State for Agriculture and Food in Defra.

Q655 The Chairman: If we may, we will go straight to the questions. The first is about a strategic approach, with reference to the Foresight Report and Food 2030. The report laid out a formidable medium-term landscape for future food and farming policy. In our inquiry we have heard criticism that the UK Government and the European Union lack a coherent

strategy to tackle what some have called the grand challenges in that landscape and that the potential of innovation in agriculture can only be realised if such a strategy exists and is successful. First, how would you respond? Can you help us to distinguish between the role of public authorities and the role of others in addressing the challenges? Secondly, do you support the previous Government's Food 2030 strategy? If so, how do you intend to take it forward?

Jim Paice MP: Yes, we do support the previous Government's Food 2030 strategy, although it is a bit like motherhood and apple pie; it is extremely vague in content and actual proposals. Therein lies the answer to the first challenge, which is the criticism that the British Government and the Commission have not faced up to the challenges that the Foresight Report makes. Until the British Government published its 2030 strategy, which is only 14 months ago, at the Oxford Conference last year, the previous Government had basically set its face against any thought that British agriculture was important. Various Ministers were on the record as saying that domestic food production did not matter and we could import it all. The 2030 document was a very welcome but belated shift of focus.

Secondly, since the new Government took office in May, it has been our number one business objective to promote a sustainable food and farming industry. We have made it clear that we believe that to be very important. Even before the Foresight Report was published, the Secretary of State and I were making speeches and comments to underline the significance that we attach to the primary industry of farming and the food processing and manufacturing industry, which is our biggest manufacturing sector. The fortunes of the two are very closely knitted together. I also tend to agree that the Commission has not yet grasped this. You may want to turn later to the CAP, but I certainly do not believe that the proposals coming from the Commission so far on the next round of CAP reform are anywhere near sufficient to face up to those challenges.

Q656 Baroness Howarth of Breckland: I want to talk a bit about localism in terms of the strategy and the document that you sent to us. Following on from Lord Carter's question, if the 2030 strategy produced by the previous Government is lacking in precision—I think you said it was woolly—will your Government be producing a document that is more precise? Presumably our report would be helpful in that.

Jim Paice MP: I am sure your report will be very helpful. We have long since recognised the value of the very hard work of your Lordships' House. We do not have plans at the moment to publish any new document. I am a very practical individual, as some of you round the table know, and I believe in getting on with things. We can publish all sorts of documents, but I just want to get on with developing and delivering policies. That is why we have worked very hard on issues to do with food labelling, a deregulation task force, tackling the challenges of Bovine TB and a range of other things that I have tried to grasp since I came to office. I want to get on and do things rather than spending a lot of time talking about them.

I am the first to recognise that there is a tremendous amount more to do. I am beginning to turn my attention to the whole issue of skills in the industry, which is very important. My colleague Lord Henley is looking at the research side, which I am sure you will want to come back to.

The substance of your question was whether there was a conflict between localism and the needs underlined by the Foresight Report. I do not think there is a conflict. The whole objective of Government is to encourage and enable the private sector, the third sector and local people—depending on which area of policy we are talking about—to get on and do things and to remove Government from those things that it need not be involved in. But

there are clearly areas that Government has to be involved in. I have just described three of them—deregulation, labelling and national issues of disease control—but I do not believe in some Government-determined plan. There is a lot more to do not just in research, but even more in knowledge transfer from research, which you may wish to come back to. There is a lot more to be done in ensuring that the market is operating more fairly. There are issues to do with supermarkets and the ombudsman.

Q657 Baroness Howarth of Breckland: There may not be a plan, but one of the things that the Foresight Report was very keen on was that there should be a strategic approach. I agree that practicality often gets things moving rather quickly, but you have to have some sense of the direction that the plan is going. My interest is that your Secretary of State said in the Oxford Farming Conference that “Over the coming years we need to increase the competitiveness of the whole UK food chain,”—that is a strategic approach—“to help secure an environmentally sustainable and healthy supply of food. Underlying all of this is the power shift from the centre towards local organisations—putting local people back in charge—a classic example of what we mean by Big Society”. I was interested, therefore, to read in your submission that in looking at the difference between the number of small farming units that exist in the total in the UK and the larger ones, it was the Department’s view that, “greatest attention should be directed towards those farms that account for the lion’s share of output as efforts can be focused on a relatively small proportion of the sector and any impact on the efficiency with which these relatively few farms convert inputs”. That is the tension I am concerned about. How do you make sure that there is a consistent localism agenda, but that it matches that delivery so that innovation and production are increased?

Jim Paice MP: I am grateful to you for the clarification. The way we see it is that the old 80:20 rule—it has always been that 80% of production comes from 20% of farms, give or take, and it applies in many other sectors—is still right. Given that our number one business objective is to promote a sustainable agriculture industry—we can all debate the word “sustainable” and what is included, but in my view it includes the economic sustainability as well as as the other issues that we always talk about—it is quite clear to me that the larger business units are overall likely to be more sustainable. They are certainly likely to be more able to make the necessary investments in new technology and so on. In that regard, I think it is right that our efforts should be concentrated towards them in terms of the Government’s role in the promotion of technology research and so on. The much larger group of farmers numerically, who are smaller in business and usually acreage terms, are still very important to our local communities, especially remote rural communities. We do not in any way remove them from the future. I would not want that to be read into what has been said or written. We are saying that their role is going to be much more in terms of niche production and finding particular outlets for their products. They are part of the overall objective of improving the sustainability of our agriculture and food production, but in my general view—these are obviously generalised remarks—they are not going to be the big contributors to the growth of the two separate issues of British food production and productivity that we need to see if we are going to deliver on the Foresight challenges.

Q658 Baroness Sharp of Guildford: Can I take you up on that? It seems to me a bit dangerous to talk about putting people back in charge, which indicates in a sense that the small man has a role to play, when you need to make a step change in productivity. From the 20:80 rule, you can make that step change by concentrating on the 20% who are going to be leading in productivity, but equally an alternative strategy is to bring up the very long tail of

the small guys. That is an expensive strategy and it is going to require a very detailed farm advisory service and so forth, which we can talk about later.

Jim Paice MP: I would be very happy to talk about the farm advisory issues, but in direct answer to your point about the smaller farmers and involving people, I come back to my point about niche and local markets. I do not take any credit for this—it is being done by the industry and the sector itself—but one of the areas is the development of more and more local food hubs, which are a whole mechanism by which the smaller producers, with no help from any Government, are coming together for themselves. Be they retail outlets, schools, hospitals, any organisation that wants access to local food can work through a food hub rather than going round a dozen different farms to get their products. This is all being driven by the farming community. That is a good example of involving people and helping those smaller-scale producers at once.

Q659 The Earl of Dundee: How should we define agricultural productivity?

Jim Paice MP: Productivity in my book is largely the output compared to the input. That includes labour, predominantly. Over the last few years we have not seen particularly good progress in agricultural productivity. We are clearly going to need to at least maintain, if not enhance, production in the future, but with lower levels of inputs—fertiliser usage, water usage and labour usage, which has been a continuing trend. Productivity to me, overall, as in other contexts, is producing more with less. It is getting more output for less input.

Q660 The Earl of Dundee: Following that definition, for the EU27 countries from 2010-19, how much of a worry is it that the OECD predicts a net agricultural output rise of less than 4%?

Jim Paice MP: It is very worrying. That is a perfectly valid point. It is a prediction that I hope we can prove wrong, because we have to do better than that. In Britain, agriculture is a mature sector, but there is still plenty of scope for further productivity. There are parts of the EU27 where there is massive scope for improvement. Some member states, for social reasons, are not too keen on that level of improvement for their rural population. Poland has close on 2 million farms with about a hectare each, or that sort of area. They are very small. The obvious ways of improving productivity would be to farm with a quarter or a tenth of the number of people. Clearly there are huge social implications to that. It is not as easy as it appears to drive that. The EU has immense potential, but it will not be driven if we continue with a long-term guarantee of an income through the single farm payment. This is taking us on to the CAP. I am convinced that it is inevitable, but I am also convinced that we will only get productivity being driven if the industry realises that it is going to be more and more dependent on its own achievements rather than on a never-ending supply of taxpayers' money through the single farm payment. That is not to say that I want to see the end of the CAP—we can talk about that in a later question, because there are a lot of other issues—but I certainly do not think that continuing the current CAP is conducive to improving our productivity.

Q661 The Earl of Dundee: You have already commented on sustainable business activities. As distinct from that, there is the term “sustainable intensification” which we hear now. What does that mean and should we deploy it?

Jim Paice MP: It is a phrase that is being used widely, including by me and my colleagues. We mean producing as much if not more food from our existing land supply—obviously land

is a constraint—without ever more dependency on inputs such as fertilisers and energy generally, which are going to become more and more expensive and in shorter supply.

To come back to the reference to Caroline Spelman's speech at the Oxford Farming Conference, this is not a choice between looking after the environment and producing food, as some farmers believe. They keep asking me which I want them to do. It has to be both. We are a small island. The public in this country all live quite close to the countryside and a lot of them want to go there, although not all. It is unrealistic to expect the British public to tolerate the desertification of the large-scale operations that exist in some other parts of the world. We have to learn to live in harmony, not just because that is public demand; it is right that we should look after our inheritance of wildlife and biodiversity at the same time. That is what we mean by sustainable intensification.

Q662 Baroness Sharp of Guildford: Can I take you back, or forward, to knowledge transfer? We have heard in our evidence over the last few months about the delivery of farm advice in England, in contrast to Wales and Scotland, and we have had evidence from some other countries, notably the United States, The Netherlands and Poland, and a certain amount about Denmark. We have heard that the variety of sources in England and the sometimes conflicting advice, driven sometimes by commercial interest, is a concern. Your written evidence points to the fact that there is a degree of complexity about the advice network at the moment and there is a need for simplification. Are you content that England has a well functioning farm advisory service? If it is to be simplified, how might we simplify it? Do you feel that where there is better practice abroad, the UK might learn from it?

Jim Paice MP: The honest answer to your first question of whether I am content with our current arrangements is no, far from it. I believe they are complicated and pretty vague to the average farmer to access. I am not advocating that we go back to a state-provided national advisory service, but I think most farmers would probably say that they were not even aware that there was any form of government advisory service. We have a proliferation of organisations, as you say. Many of them are commercial bodies, land agents and independent consultants. They all do a very good job in their own way, but inevitably in some cases there are commercial biases, although I am tempted to say that it was always thus. It is risky going back into your own life, but years ago all your agrochemical advice came from your local supplier of agrochemicals. In one way that was just as biased as anything today. It was not quite as green-grass in history as we might like to think. Then you have the national agencies, such as the Environment Agency and Natural England, and charities such as the RSPB and others, all providing different sorts of advice. I think the average farmer is confused about all this. If I may jump a little, because I know you want to talk about the AHDB later, I personally see that as the organisation within the farming community—outside the direct arm of Government, but still loosely within the government umbrella—with their role of rationalising and driving forward a much more accessible and simple system of advice to farmers.

Q663 Baroness Sharp of Guildford: We had a letter from you, which was only written on Monday, about setting up an integrated advice pilot for farm advice. How do you see that going forward? Is the AHDB involved in this?

Jim Paice MP: Forgive me, but I am going to have to turn to Sue Popple.

Sue Popple: Yes, they are involved.

Q664 Baroness Sharp of Guildford: You were saying that you wish to see something less complicated. I take it that this is a pilot that might provide such an advice system.

Sue Popple: Yes. There are a number of different streams, including within Government, that are all giving different advice on different topics. The intention is that there could be benefits by bringing those advice streams together, with much more consistent messages being given by the people who are acting in an advisory capacity.

Q665 The Earl of Caithness: Minister, I agreed with your earlier remark that the CAP has been a brake on productivity. Do you think it has also been a brake on getting advice to farmers? The current CAP is limited to cross-compliance for giving advice to farmers. How would you like to see that reformed?

Jim Paice MP: It needs to be part of the totality. Why separate out cross-compliance from all the other things that farmers need advice about? I think that is somewhat odd. We are in the process of re-examining the whole thing. As you are probably aware, the current process is delivered under contract by AEA on behalf of Defra by Natural England. We have just extended it to the end of this year. The reason I extended it was to buy us a bit of time to have a complete rethink about all of this. I do not see any point in having a separate stream of advice simply on cross-compliance. To me, cross-compliance is simply good farming. As someone who has spent most of his life in the industry, anybody who reads most of the cross-compliance rules would say that we should be doing that anyway. There are one or two specific bits, but generally I think that is the case. Frankly, I do not see the need for a specific, unique stream of advice just to deal with that.

Q666 The Earl of Caithness: In the evidence that we have received, particularly from other countries in Europe, there has been a remarkably wide range of views about cross-compliance. For instance, in Poland a lot of farmers needed their hands holding for filling in basic forms and getting used to the whole EU bureaucracy that we are all thoroughly used to and live with. What have you and your officials learnt in your discussions with other European countries to give you hope that this might be changed and there is a better way forward?

Jim Paice MP: I will ask Sue to comment in a second, but if I am honest I do not think there have been a huge amount of such discussions with other countries about what they do. My understanding is that, although as you say the EU provides money for advice on cross-compliance, I am not aware that it says that that cannot be used in conjunction with other forms of advice. It does not have to be a unique stream. That is my understanding. As far as contacts with other countries, have we had much, Sue?

Sue Popple: There has been contact with other countries in the general context of knowledge transfer and ways in which it could be improved across Europe. A lot of that comes down to what the Minister said earlier about there being a lot of different types of farming business across Europe, so one size is not going to fit all. It is trying to pick out the best of those systems and how they could be used in other places.

Q667 The Earl of Caithness: A quick final question: when do you expect to be able to give us further advice on your thoughts on this? Have you got a timescale?

Jim Paice MP: Not a precise one, but towards the end of this year, I would hope. We have only extended the cross-compliance advice to the end of this year, so that is the sort of timescale that we are working to.

Q668 The Chairman: Ms Popple, can I come back to you? Of those emerging themes, could you share with us the things you have learnt that may be commonly applicable across Europe?

Sue Popple: I have not been involved directly in the discussions, but it has been around whether you need one-to-one advice and whether there are other ways in which you can give advice on the types of packages that could be used elsewhere, where people are looking at more novel ways of putting advice across, perhaps through the internet. Perhaps we could provide you with more information on that if it would be helpful.

The Chairman: The Department's emerging thinking on that would be very helpful if we could get it.

Q669 Baroness Sharp of Guildford: I take it that that is being fed into this integrated advice pilot. In developing the pilot, you are taking into account what you feel you have learnt from these other countries.

Sue Popple: Yes, I am sure we would want to be able to do that.

Q670 Lord Cameron of Dillington: I would like to ask about the Technology Strategy Board and its sustainable agriculture and food innovation platform and the knowledge transfer networks. Perhaps you could expand on how they work and whether they are successful.

Jim Paice MP: I think it is very early to judge whether they are successful. They were brought in by the previous Government, but as far as I know no changes have been made. It is a new initiative to bring the concept of government business and researchers together to develop the technologies that industry and society need for our farming sector. We are going to see investment of up to £90 million from the Government over five years, which includes £50 million from the Technology Strategy Board—that is new funding for the sector—£30 million from Defra and £10 million from BBSRC. That is to provide matched funding for technological research and R&D in all agricultural areas, but particularly crop productivity, livestock, waste reduction and greenhouse gas reduction.

The first call for research has resulted in the funding of 32 projects, totalling around £13.6 million of government funding with that matched contribution. The second call was launched just last month, in February, and will provide up to £15 million in government funding for research to tackle the challenge of a sustainable protein production, which I know that a lot of NGOs are very concerned about. The call includes research covering crop, animal and fish protein for feed and human consumption. Obviously, we do not have an outcome for it. That is where we are at with the TSB.

Q671 Lord Cameron of Dillington: Picking up on the technology transfer involved with climate change, how are we going to encourage farmers to adopt probably quite new technology and results coming from some of the research you have been talking about, to pick up the baton of climate change? Can we have benchmarking and systems that effectively make them think about it in their practices?

Jim Paice MP: As you are probably aware, the industry has set up a greenhouse gas emissions group and they are about to launch their action plan—I think it is next week—in your Lordships' House, which will turn the overall proposals into real action. As I implied earlier, my main concern is that they deliver on it, and that is going to mean a huge amount of effort within the industry to persuade farmers that they all have a role to play. Alongside this, we announced in the autumn that we are spending £12 million on more research into

agriculture emissions. This is very important, because up to now we have operated on almost a wet finger basis—that is a slight simplification, but we are not very clear about what agricultural emissions there really are and the interchange between absorption of food crops and emissions. This project that we have started to fund is about bottom-lining the situation so that we really know where we are and how we can take it forward.

Agriculture has to deliver as part of the Government's overall climate change strategy. The Climate Change Committee has set targets for agriculture and will set further ones. We are clearly going to have to deliver, so we have to get that bottom line and implement the action plan. In that regard, the benchmarks question is answered in those papers that the industry has developed. All of us have a role. The industry has to take ownership of this primarily, bringing it back to the AHDB as well, and drive this forward and make sure that everybody plays their part. We also fully appreciate the pluses and minuses in agriculture. It is not quite as simple as a conventional industry.

Q672 Lord Cameron of Dillington: On the AHDB, which you have already mentioned, are you in a position to say how it can perform better and play a proper role? I agree that it has a hugely important role to play, but I am not quite sure how we set it up to do so.

Jim Paice MP: As you may know, the Government announced as part of its overall review of arm's length bodies that we would review the AHDB, including the options of taking it out of Government. As you know, it is funded by a statutory levy and is effectively an arm's length body of Government, although they do not particularly want to see themselves like that and I do not particularly want them to be like that, but that is the way it is.

We have commenced that review. Only last week we organised a conference at Stoneleigh, where we invited all the interested parties and stakeholders and I addressed them. I take a very strong view that the AHDB is for the industry. They are paying the levy and at the end of the day they should be deciding where their money goes and how it is being used—or they can decide, through a ballot, to stop paying the levy at all, in which case the whole thing falls. I think that would be a disaster for the industry, but it is up to the industry.

I made the point to them very clearly that we are, quite rightly, going through an era where Governments are moving back away from trying to run industries. Agriculture is perhaps one of the last ones that the Government is slightly separating itself from. It started, I suppose, with the advent of the single farm payment, when Ministers stopped setting prices in one way or another. We want more resources to be put into the rural development programme, not just in terms of environment conservation and stewardship schemes, but also to stimulate competition, innovation and help with those things rather than the longer-term ongoing subsidy that the industry is used to.

If we are going to see that era, it is hugely important that the industry has its own professional body. I do not mean to clash with the NFU or the CLA, but it is more of a technical professional body. That is what I see the AHDB potentially doing, but if it is going to get there, we need really good, innovative leadership. We are in the process of appointing a new chairman, so I cannot go there. There is a vacancy and the interviews are under way. I hope we will appoint somebody who really sees a future for this industry and wants to pull it forward. Then, of course, you have the sector board chairmen as well and the boards, but it needs that leadership if we are going to get it anywhere.

Q673 Lord Cameron of Dillington: The Danish system is that they have a compulsory, legally enforceable levy on all farmers to pay for their advisory service. You would not consider going down that route? Would you prefer to keep it voluntary?

Jim Paice MP: The AHDB is a compulsory levy.

Lord Cameron of Dillington: Yes, but it is voted on by farmers rather than being put in place for them. As you say, they could vote to stop it.

Jim Paice MP: They could vote to stop it. That is true. To digress, two years ago the New Zealand farmers voted to stop their wool levy, which caused havoc among what was then the meat and wool board. If I may say so, this is almost pedantry, because what really matters is that if we make the AHDB the organisation that I believe, and I think you believe, that it should be, they are all going to pay the levy willingly. They need to see where their money is going, what they are getting for it and whether it is delivering the services, including advice, that they really need. There will always be gainsayers, but I think the industry generally will pay up.

Q674 Lord Cameron of Dillington: Finally, who should be persuading consumers that we should be accepting new technology in agriculture?

Jim Paice MP: That is a little jump there. I am on record as saying that the worst people to advise on that are Ministers, because the public view with some scepticism assurances given by Ministers, for probably justifiable reasons. The retail trade has a big role to play. All the evidence is that the consumer, rightly or wrongly—I do not pass judgment—believes that anything they are being sold by the major retailers is safe, good and wholesome. They have a lot of credibility in that regard. Obviously there is also the scientific community, with the Food Standards Agency speaking on food safety. Frankly, although it will not work with every consumer, I think the farming industry and the research sector also have a role to play in trying to explain and kill off some of the more absurd myths that they hear about such things.

Q675 Lord Giddens: What timetable do you have in mind for getting farmers to report on and control their greenhouse gas emissions? I work in the field of climate change. Everywhere you look is full of proposals for doing this or that, but very little concrete gets done. Global emissions are still increasing. What kind of timetable do you think would be effective in getting British farmers, and then farmers across the EU, to take concrete action? At the moment there is very little data on what greenhouse gases are produced. As you say, it is a complex issue, but there is not a lot of data on individual farms. That could take quite a long time.

Jim Paice MP: You are right. There is not a great deal of data. That is why we have set up this £12 million project to try to generate that data. As far as individual farms are concerned, a number of organisations have produced various forms of on-farm calculators. They are probably pretty rough and ready, but they do exist. The principle is that the industry is about to launch its action plan—I have not seen it—which will contain its timetable, which I believe is four years, but I stand to be corrected on that.

Q676 Lord Giddens: Do you mean a four-year timetable before anything is actually done?

Jim Paice MP: No, the action plan is over a four-year period, starting the day it is launched. Even though there is a shortage of information, what there is indicates that agriculture has already substantially reduced its emissions over the last decade or two, with lower nitrous oxide emissions from fertiliser and lower energy use. The two main emissions are nitrous oxide and methane. A lot of work is being done on methane reduction through dietary

changes. I am going to Liverpool University in a fortnight because they have done a lot of work on changing diets of dairy cows to reduce methane.

Q677 Lord Giddens: What concerns me is implementation and the practical consequences.

Jim Paice MP: I agree. That is where the action plan comes in.

Lord Giddens: In the whole of climate change debate there is a lot of talk but not much action across the world, in almost every sector you look at.

Jim Paice MP: I would not deny that.

Q678 Baroness Sharp of Guildford: I have two short questions. First, you talk about industry leading the strategy. Who is industry? Is it the NFU?

Jim Paice MP: In the agriculture industry on climate change it is jointly the NFU, the Agricultural Industries Confederation, which is the supply chain, and the CLA.

Q679 Baroness Sharp of Guildford: Secondly, on consumers, you were saying that we need to leave it to the big supermarkets and so on. One of the big problems is wasting food. Can we really leave it to the supermarkets to drive that one as well?

Jim Paice MP: Probably less so. The word was not used, but I was talking about GM, which I suspect was not far behind Lord Cameron's thoughts. Food waste is a huge issue. As the Foresight Report says, if we could reduce food waste, it would make a huge difference to global supplies. The retailers have a big role to play and many have begun to realise that they should stop offers that just encourage people to buy food that they do not need. Buy one, get one free, even if you only want one, is fine if you put the other one in the freezer, but if it sits in the fridge until it goes mouldy, it is not much help. So I think the retailers have a big role to play.

Stepping forward a bit, I mentioned in my earlier remarks the supermarket ombudsman or adjudicator that the Government is pledged to bring in relatively shortly to enforce the code and terms of practice. You may wonder where I am going with this, but one of the terms that supermarkets often impose on their suppliers is that they have to carry all these deals. If the supermarket decides to do a buy one, get one free, or a buy three, pay for two, or whatever it may be, they often expect that to be funded by the supplier. If we get to a more sensible relationship between suppliers and retailers, through the use of the code and its proper enforcement by the adjudicator, I think we will see a gradual reduction in that sort of behaviour, because it is extraordinarily unfair on a producer of lettuces, for example, to be told that they suddenly have to fund that when they have had no say in the matter. The supermarket comes along and says that it has decided to do a special offer on lettuces, so in future that is how you will label them and sell them to the supermarket. You cannot go on like that. It is a longer-term process, but I think it will happen. The other point is just simple education of the public that we need to look after our food as a resource.

Q680 Baroness Howarth of Breckland: I think you have just answered my question, but I was going to ask you what role the Government plays in all this. We have asked a number of witnesses the same question, and many of them have felt that the Government should have a central role in advising consumers and take a rather different view about whose view is heard. I wondered what else Government could do. This is the crunch, particularly in some innovations like GM and cloning, when people have the "Frankenstein

food” ideas in their minds. We need someone to put the rational arguments forward. There are other people. But what is the Government’s role in that?

Jim Paice MP: Government’s role has to be to make the rational arguments, as you say, and to try to explain those things. Where there might be a debate is how much notice the public are going to take if the Government says it. That is why I genuinely think that if we can find others whom perhaps the public trust more, their voice is more likely to be heard. It is not that the Government should not be doing it. The much more fundamental point is that I am not sure that it would make a lot of difference if the Government does it. There have been so many myths and so much misunderstanding about GM and cloning, such as the “Frankenstein food” business—you only have to be an MP receiving constituents’ letters to see it—that we all have a responsibility to correct fundamental errors, although not everybody lives up to that. There is still room for debate, discussion and choice.

Q681 Lord Giddens: Can I ask a bit about basic and applied agricultural research? How does the Government intend to improve its support for agricultural research and the translation of it into agricultural practice? We have heard quite a lot of evidence from different parties about defects and failings in the existing system.

Jim Paice MP: Last year across Government, our UK food research and innovation strategy was published. That provides a coherent framework to support and enhance the research capability and the translation of its research into use. Defra is working with other departments and other outside bodies, funders and industry through the Food Research Partnership, chaired by the Government’s Chief Scientific Adviser, to look at research skills, research capacity and the translation, exploitation and how it can be addressed if we are going to maintain research and innovation in the context of the Foresight challenges.

It has to be said that, as everybody knows, funding is short. I am not going to pretend that there is oodles of extra money to pour into it. But that first work has begun to bear fruit. I talked earlier about the money that Defra is putting into the platform, with the TSB. We are also working on the Taylor review, named after your colleague Lord Taylor of Holbeach, who drafted the report when he was part of the opposition team a year or so ago, which Lord Henley and I are now trying to implement. His report was widely welcomed in the research and agriculture community. He made a number of proposals. One of them, which is very relevant, is the issue of transfer and the concept of demonstration farms—not reinventing the old ones that we used to have with ADAS, but the idea of using private sector farms and encouraging them to be demonstrators. They already exist in some cases—LEAF, for example—but using an existing commercial farm to apply a new technology or some sort of research and organising the arrangements whereby everybody else can access it and witness it as a means of transferring the very good research that we do and getting it across to operation in the field. That is very important. Defra’s own evidence and investment strategy has to be about value for money and about stimulating private investment in research and development and in knowledge transfer. I am sure we are open to criticism. We could always spend more on research.

Q682 Lord Giddens: What concrete proposals or policies do you single out as significant? That is a very general reply.

Jim Paice MP: It is a general reply, but I do not think I am competent to say that we should be researching X, Y or Z in detail. This is where the industry is so important. It is for the industry to identify with the research community. That is why we have research councils and things, to advise on what research is most relevant in the future. The whole area of

precision farming is clearly of huge importance, because that is how you can get more for less. It is about applying your inputs in a much more targeted way, so you use fewer inputs and have less impact on the climate, and so on. I do not really think that Ministers should be identifying what a research project should be. We all have our ideas, but I would not want to say that they were right, although I would like to think that they are.

Q683 Lord Giddens: With respect, that is not quite what I was asking about. Can I move on to universities, because time is pressing? Do you worry about the lack of image that degrees in agriculture, soil science and farming have in universities? What can be done to improve the attractiveness of such courses to the younger generation? We have heard quite a lot of evidence about that.

Jim Paice MP: I do worry, but I tend to look at this from a slightly different perspective. We can spend a great deal of time talking about the right course, the right qualification and the right mode of study, but first you have to interest people in what they are trying to do. Then they will choose the right course and mode of study. Whether we are talking about a farmer's sons taking over from dad or talking about a highly intelligent, intellectual person who wants to come into agricultural research, we need to make the food and farming industry an attractive and respected industry to work in. In as much as Government has a role to play, it should be an industry that can deliver a satisfactory income and terms and conditions and provide a career opportunity. People are not going to go into our industry necessarily on the basis of what their father did, or with the kind of unsocial hours that have been traditional with older generations. We have to make the industry more attractive. The Department is doing all we can to raise the industry's profile and importance. That is why I always link farming to the food industry. They are essential and it builds up the significance of farming. I am convinced that the way we address this, without getting into technicalities—I would not pretend to be the world's expert on that—is to make people want to go into the industry in the first place.

Lord Giddens: There is one further factor in terms of student appeal, which we might consider. Agriculture is now at the centre of massively interesting changes and innovations which go over into biofuels, sustainability and climate change. Those things are likely to be more appealing to students than our traditional image of agriculture. It would be helpful if they were promoted as a means of drawing students into the area. It is amazing what is going on. This is a very cutting-edge thing. Some work could be done on that which would improve the appeal of courses to students and investment in research in universities.

Q684 The Earl of Arran: European innovation partnerships have been strongly flagged up and are due to be rolled out across Europe. They ought to be the best thing since sliced bread. Apparently, one of them is going to deal with agriculture next year. Do you think there is any credibility in such a concept and how can you see it working?

Jim Paice MP: I sense an element of scepticism in your question. I am not usually very perceptive, but I think I have spotted that one. If I am honest, I probably share a bit of it. It is early days. The Commission has proposed that we have a partnership on agriculture, productivity and sustainability that would promote an industry that is more resource-efficient and productive, building the bridge between leading-edge research and the technology's application. But it is very early days. We are working with colleagues in BIS and other government Departments with the research councils and other member states on a whole range of EU initiatives that have been proposed. There is nothing tangible yet to get hold of and pass judgment on.

Q685 The Earl of Arran: The worry is that, as always, it could just become a talking shop.

Jim Paice MP: I do not think I am going to argue against that.

Q686 Baroness Sharp of Guildford: We had some very interesting figures the other day that looked at total factor productivity in the agriculture sector. You could have reservations about these, but it showed that over the last 10 or 20 years, the UK had more or less flatlined—certainly over the last 10 years—whereas other European countries, particularly Germany, had shown very considerable increases in productivity. We can be sceptical about what this partnership will achieve and whether it will just be a talking shop, but are there not genuinely things that we can learn from our European partners?

Jim Paice MP: Forgive me if I gave that impression. I certainly agree that we should always be open to learning from our European partners. I just have question marks over whether some EU-imposed initiative is the way of doing it. You are absolutely right that we should learn from our German partners and yes those statistics do worry me, showing that we have not improved our productivity.

Q687 Baroness Sharp of Guildford: We are basically half way down the European table.

Jim Paice MP: I know. I have seen the figures and I am far from content with them. As I said earlier in reply to a question about what productivity was about, we have to do better. The competitive edge is the final point economically, but we also have to do better if you look at sustainability as well, with lower use of resources. No, I am certainly not satisfied with those figures. I probably never will be.

Q688 Baroness Byford: Minister, I have two observations and then some questions, if that is all right. I was really pleased that you spoke up about the importance of agriculture. It goes back to the first question about the Foresight Report. I do not know how the Department feels, but I would have thought that the shortage of food and the whole question of food security will surely raise that up the scale. People will want to be involved actively in it, so I hope that future youngsters will see this, not as something to save the world—that is putting it too high—but as an attractive industry to come into. The second point is underlying the importance that you attach to the AHDB. To me they are very key. I suspect that you have had the same response from other colleagues. One of my questions on that is how long you think it will take the AHDB to get up and go in the way that you see it going—or is it already there?

Jim Paice MP: It is certainly not there. Very far from it. I am not sure I can put a timetable on it. We are in the process of appointing a new chairman. I am hopeful that whoever that is will be the right person to give it a kick where it matters and to lead it forward. They have spent the last three years being bogged down arguing about where their offices were going to be. That is a slight over-generalisation, but it seemed that that was all they ever talked to me about. We have to move on from that. Fortunately, that matter is now resolved and they have to move forward. I am not going to set them a timetable, but there is an urgency from the industry's point of view and there is an urgency back to the point of a ballot. I do not want, as a Minister, to be faced with the industry demanding a ballot on the future of the AHDB, but that could happen if farmers go on feeling that they are not getting their money's worth.

Baroness Byford: Thank you for that. I shall turn to questions on the CAP. The Secretary of State and, I think, you are very keen that the subsidy regime is phased out and it becomes a much more market-driven industry. My worry is whether you are confident that you will be able to persuade other countries. I am particularly thinking of Poland, which you mentioned earlier, as well as France and other countries that are based on small farms. How do you see them managing to compete against the bigger groupings, which we tend to have in this country? Is there a logistic problem, or can you see light at the end of the tunnel?

Jim Paice MP: The inevitability of any negotiation involving 27 member states, plus the European Parliament since the Lisbon Treaty came into force—it is co-decision-making—is that no country is going to get everything it wants. We would be fooling ourselves to think that. Our view is that we should use the Foresight Report and the projections as a basis for saying that this is where we should be going. We clearly need to increase our production and productivity. We clearly need to use fewer resources. We therefore clearly need to innovate and be competitive. But equally the benefits are there and the opportunities are there because of increasing demand. Therefore, the opportunity for farmers to gain more of their income from the market for their foodstuffs that they are producing is clearly there, too.

Therefore, the development of the CAP over the next seven years of the plan should be against that background. It should not be about simply greening the status quo; it should be about trying to develop the industry in that way. We are not advocating an end to the single farm payment during this seven years, but we do think there should be some sort of strategy towards its gradual reduction and elimination at some stage in the future. I do think it stultifies competition and I do not think it is helpful in enabling the industry to go on. We also believe very strongly that the other part of it, the rural development programme, is important. I think the previous Government paid insufficient attention to the issues of competitiveness, whereas we want to see a bigger share of resources in the competitiveness part of Pillar 2 so that we can really help the industry to equip itself for the days when the direct payment is reduced or eliminated.

As for how we get on with other member states, inevitably it is extremely mixed. We have a few who are almost 100% on side with us and others agree with some bits of our ideas and not others. I am not in a position to prophesy the outcome. You have some Agriculture Ministers who say that they want more money in the agriculture budget when we know full well that the same countries' Finance Ministers are saying at Ecofin meetings that they will put less into the agriculture budget. There is a whole raft of things and it would take the wisdom of Solomon to see the future ball. My guess is that the single farm payment will continue. There is no doubt about that. There will still be a Pillar 2. I hope that we will not see some of the complexities brought in that the Commission is proposing and I hope that we will see a reduction in the funding for Pillar 1, the single farm payment, and an increase in funding for Pillar 2, not just overall but also in the UK's share, because our share of it is very small. Both the Secretary of State and I are actively engaged in conversations with our colleagues around Europe to try to achieve as much as we can of our objectives.

Lord Cameron of Dillington: The key fact to remember is that when New Zealand went into the free market, I think 3% of its farmers went under, but 64% of its Ministry of Agriculture officials were made redundant. So the Commission is very unlikely to come up with a free market proposal.

Q689 Baroness Byford: On that, the UK Government is not likely to take a stance that would then disadvantage us, where you would have farmers who were being protected in their own countries in a way that UK farmers were not able to be.

Jim Paice MP: That is certainly not our intention. We want to get the best deal for the UK, and that includes the UK farmer and the UK taxpayer. We certainly believe in the single market and we want whatever arrangement comes out to be equally applied. That is why we want to see an end to coupled payments, which some countries still have. It is why we oppose the idea of a cap on the maximum payment under the CAP, because we have larger farms and we would lose out on that. It is why we oppose special payments for small farms, which some countries want. We want our country to get a fair share of whatever emerges.

Q690 Baroness Byford: Lastly, and very quickly, this evidence is about innovation. Are there any restrictions within the pillars at the moment, particularly Pillar 2, that could be released to help to direct some of that money towards innovation?

Jim Paice MP: There are some restrictions. One of our objectives when we get a bit further down the road will be to try to open up Pillar 2. We think that research and innovation should be fundable out of Pillar 2 money. You can argue about where competitiveness and innovation stop and start. Competitiveness and that side of it is eligible today under Pillar 2 funding. Direct innovation, in terms of research, is probably not, but we could push the boundaries a little bit. I have to say as far as the current programme is concerned, until the end of 2013, there is very little spare money that has not already been allocated.

Q691 Baroness Parminter: Do you believe that EU regulation is striking the right balance between delivering the opportunities for innovation and at the same time meeting the reasonable requests of people's concerns about societal impacts, environmental concerns and animal welfare? If not, are there are particular areas of EU regulation where you think they are getting that balance wrong?

Jim Paice MP: My view is that the EU has tended to reach for regulation as the obvious answer to any issue. You are absolutely correct that there are many issues, environmental and societal, that society is concerned about. I do not believe that by regulating you necessarily get the best buy-in from, in this case, the farming community, or the best outcomes. That is why the study that I commissioned from Richard Macdonald, the former director-general of the NFU, who is due to report in a couple of months or so, is not about getting rid of regulation as much as we would like, but it is much more about how we enforce and implement those regulations. The objective is usually quite sensible, trying to achieve something that most people would agree with. The burden on the industry is in the amazingly bureaucratic way in which we have become obsessed with the process by which they deliver it rather than whether they deliver it. That is the long-term legacy that I hope Richard Macdonald's report will deliver. I know he has been to the Commission and it is a message that we are trying very hard to persuade on the Commission. It is much more one of trust. You accept that the vast majority of farmers want to do and will do the right thing. It means you have to be ruthless on those who do not, but overall you will get a much better buy-in and feeling of ownership by the farming community rather than feeling that they have Big Brother telling them what to do all the time on what they often think of as "my land". You can achieve much more that way. The quid pro quo is that you have to be very tough on those who breach the trust that you put in them.

The Chairman: Minister, thank you very much. I think I speak for the whole Committee when I say that we are always very pleased to see you, with your frank and very experienced insights that you are able to bring. Thank you very much.

Supplementary written evidence (IEUA 41)

*Q: What approach will the Government take to EU policy in the area of basic and applied agricultural **research** within the context of discussions on the future Framework Programme post-2013? Might a more flexible approach orientated towards grand challenges, such as climate change and food security, be more effective than the current rather rigid thematic approach, which skews funding towards ICT and health?*

A: In response to the BIS “Call for Evidence” on FP8, Defra highlighted food security and climate change, along with the protection of natural resources, as global societal challenges that should be addressed by EU research and innovation. A grand challenge approach might be a better way of establishing priorities, and shifting from an outputs to an outcomes focus in the next Framework Programme, however more information is needed on how the challenges would be defined and the mechanisms that would be used in taking this forward.

As indicated in the question, a flexible approach is needed and the next Framework Programme should be able to address new and emerging issues. Current processes mean that EU funded research can take several years to complete, while evidence needs tend to change on timescales that are much shorter, to match shifts in the policy focus. Streamlining of processes and the possibility of funding shorter, more focussed, projects would likely provide better tailored evidence from the next Framework Programme.

The grand challenges themselves are dependent on research and innovation in other areas. There would still be an important role in the next Framework Programme for enabling technologies such as ICT and underpinning areas of research, such as the social sciences and humanities. Linkages between the grand challenges themselves should also be addressed through, for example, coordinated and joint calls. And, whatever the approach taken, accessibility to research outputs will need to be greatly improved if impact is to be increased.

SCAR Collaborative Working Group on Agricultural Knowledge and Innovation Systems (AKIS) (N.B. Started in May 2010; work still in progress)

1. Background discussions for the AKIS Collaborative Working Group (CWG) concluded that: European Farming and agro-industry need knowledge from many different sources to compete with quality products in a globalised world. Climate change mitigation and adaptation and recent fears related to food security are new challenges. Compliance with standards concerning the environment, food safety, animal health and welfare need integrated approaches for optimised farm management.

2. Farming is much more diverse than in the past. It is combined with other activities. New knowledge is generated by farmers, researchers (basic and applied) and private companies. The old linear model of technology transfer (from scientists to the users) is therefore outclassed and should be replaced by an interactive model of networking systems, which integrate knowledge production, adaptation, advice and education.

3. Advisory and extension services were considered likely to play a significant role in the development of any future European agricultural knowledge system. Therefore the findings

of the CWG could be interesting to the Commission, in particular in view of its report on the Farm Advisory System (submitted to the Council in 2010).

4. AKIS agreed a number of different work packages and deliverables:

1) Reflection paper on AKIS as a basis for the work: This will include a consideration of what AKIS should cover; strengths and weaknesses; drivers and incentives; agricultural and rural policy context; research, extension, public/private actors, beneficiaries, advisory services.

2) AKIS policy: Motives, consideration and driving forces, dynamics of the AKIS system and policy to monitor and organise it.

3) Social innovation: relevance for the food system, agriculture and rural development ; people's attitudes; benchmarking; relation to AKIS.

4) Managing complexity and porosity: interconnections between subsets; obstacles; synergies and conflicting interaction; role of education; relation with other science and education fields.

5) Case studies; Not intended to compare countries or cases but answer "what can we learn from the cases?" e.g. in relation to WP2. A synthesis report on case studies will be included in the final report (due in 2012).

5. The (draft) reflection paper suggests that across EU member states: "The concept of agricultural knowledge systems based on a strong integration at national level of public research, education and extension bodies, under the control of the ministry of agriculture has been put into question both theoretically and empirically for three reasons: 1) research, education and extension have incurred a deep re-structuring. The trend to liberalisation has radically changed the systems, leading to privatisation of delivery, multiplication of extension organisations, farmers' participation to the costs, competitive bids to assign research and extension tasks, tight evaluation procedures. 2) the increasing concern with the environmental impact of industrial agriculture, with the quality of life of rural population and rural employment, with the production of positive externalities linked to agricultural production, has modified the policy agenda, putting new emphasis on rebalancing and integrating agricultural policies with rural development. 3) the linear model of innovation is progressively replaced by 'bottom-up' and network approaches, according to which innovation is co-produced through interaction between firms, researchers, intermediate actors (input providers, experts, distributors) and consumers.

6. The paper also indicates that the structure of agricultural knowledge systems and in particular how they are organised and governed (public or private structure) differs a lot from one country to another, as well as the level of centralisation or decentralisation.

7. Mainly privatised systems (Netherlands, some states in Germany) where the funding mainly comes from direct payments by farmers and where AKIS is managed by private bodies) [The evidence given to the HoL enquiry suggested that Denmark also has privately run advisory services]

8. Co-management between farmer organisations and the state (France, Finland, some states in Germany), with public funding, partial payment by farmers and many farmer organisations. [Discussions in the CWG suggest Latvia and Hungary have collaborative public-private services]

9. Management by the state with regional organisations (Switzerland, Italy, Finland). [The evidence given to the HoL enquiry suggested Poland retains a central advisory service run by

the Ministry of Agriculture and Rural Development. The CWG was informed that Ireland's advisory service Teagasc receives a state grant but also charges fees- some states' Farm Advisory Services appear to be similar]

10. Generally, public systems face similar problems, like lack of capacity, a role conflict (the same organisation as a controller and as an advisor), management and motivation issues, methods and staff qualification etc.

11. Private systems cause different sets of problems, like closure or unstable employment opportunities for advisers and unequal financial means to profit from extension services, thus favouring large holdings or more profitable farms.

12. The other AKIS CWG work packages are still at an early stage. The case studies in WP5 should provide more details of strengths and weaknesses - the next AKIS CWG meeting (May in Budapest) has a planned discussion session on systems operating in different states or regions.

John Deere

Oral evidence, 6 April 2011, Q 711- 737

Evidence Session No 22. Heard in Public.

Members present

Lord Carter of Coles (Chairman)
The Earl of Arran
The Earl of Caithness
Lord Cameron of Dillington
The Earl of Dundee
Baroness Howarth of Breckland
Baroness Parminter

Examination of Witness

Mark James, [Product Line Manager, John Deere].

Q692 The Chairman: Good morning and thank you very much for coming, and thank you for your excellent note. It really was most helpful. I shall deal with the formalities. You have in front of you a list of the interests that have been declared by Committee Members. This is a formal evidence-taking session of the Sub-Committee and a full transcript is being taken. That will go on the public record in printed form and on the parliamentary website. We will send you a copy of the transcript and you will be able to revise it for minor errors. The session is on the record. It is being webcast live and will be subsequently available via the parliamentary website. For the record, could you state your name and position, and then we may go to the questions?

Mark James: My name is Mark James. I am the UK product line manager for agricultural management solutions, which is, very loosely, GPS-based products, and for crop-spraying equipment for John Deere Ltd. My role, roughly, is that I am the communication line between our factories—which are generally based in mainland Europe and in the US—and

our UK sales branch and dealer network. I am passing information between factories and the UK market all the time.

Q693 The Chairman: Could you say a bit more about the innovative developments in agricultural machinery and the system you described in the note? Particularly, what is going to be their impact on productivity, balancing that against environmental performance? I think you have covered this in your note, but perhaps you could tell us a bit more about what you see as the drivers for innovation—how we might get people to do this quicker and what effects they may have.

Mark James: Precision farming, if you want to call it that—it may or may not be a good term—is a wide subject. I have focused in on a few areas that I want to elucidate on a bit more this morning. The first is GPS-based guidance systems. I shall go back and explain their use a little more and why we might be interested in them. Take the example of an operator driving a tractor, a combine, a sprayer or whatever it might be in the field, and doing the job effectively by eye. We know that they tend to overlap. They absolutely do not want to miss any areas of the field, for whatever reason, because that is potentially a disaster—it is a weed spot, a disease patch, or whatever it might be. They are not going to miss any areas, but because of that they tend to overlap. That level of overlap will be relatively small when they are fresh, early in the day, but as the day goes on the overlap will increase as they get tired, or the conditions deteriorate—it gets dusty or dark, for example.

Typically, you will find that those operators in the field, over a working day, will have an average overlap of around 10%. It is less in the mornings and more in the evenings or when they get tired. That level of overlap means that there are areas of the field that might get cultivated twice with a cultivator. There are areas of the field that might get sprayed twice if they are operating with a sprayer. If they are applying fertiliser, they might put that on twice. The issue is that damage to the environment could occur, but for the farmer it is lost money. Where they apply a chemical twice, it might damage the crop. Where they apply fertiliser twice, given the cost of fertiliser, they have effectively wasted it and did not need to put it on. It really means lost money for them.

Various means to eliminate that were tried, but in the last few years the answer has become GPS-based guidance systems, using global positioning systems. We do that in two ways. First, we can do it with the operator still steering the machine—what we might term a manual guidance system. At its very simplest, there would be just a row of flashing lights in the vehicle cab. These lights would flash to the left or the right to show the operator which way he needs to steer to be at exactly the right width for his implement and exactly parallel with the previous work. In its simplest form, it would be a row of lights or what we call a light bar. It might be a little more complicated than that—we might have an LCD display in the cab—but effectively the operator is still steering the machine, but with an aid to help them to steer exactly parallel and just at the right width.

To go to the next step, we would effectively take the operator out of the system and use the global positioning system to steer the machine—so it means automatic steering. Again, at the headland the operator would engage the system and take his hands off the steering. The machine would steer itself up the field at exactly the right width and exactly parallel with the previous work. You can do that in straight lines or in curves. If you want to—some implements do demand it—you can miss a few passes on the headland and pull in the field a little further along and then fill in that area that you have left. Some implements demand that you do that. So it is quite a flexible system.

Again, the point is to eliminate the overlap, because if you overlap it costs money. Typically, we can see savings of between 6 and 10% on implementing a GPS-based guidance system on any given machine. It means that the owner and operator of the machine can save 10% in fuel, you finish the field in 10% less time, you waste 10% less fertiliser and you over-apply 10% less with sprayed chemicals. If you use that system to sow or drill the field and you are putting tramlines in the field to follow on further passes with spray chemicals or fertilisers, the fact that you do not have any kind of guidance system on your sprayer or fertiliser spreader really does not matter, because you put the tramlines in the right place to start with and then you can follow those through the rest of the season.

It is an interesting and purely practical development. From the point of view of the farmer, the beauty of a GPS-based guidance system is that the payback is clearly calculated. As soon as they put it to work in the field, they start to save money, which is important. Potentially, that means that they can justify buying equipment that could be used for further operations over and above using it as a guidance system. Guidance systems are quite a growing business. Automatic steering for the vehicle is used by around 4,000 machines in the UK, and it is growing all the time. It is starting to take off. To put that into context, I believe—I do not have good figures to prove this—that there are around 100,000 to 120,000 front-line tractors working every day on farms. We have scratched the surface on GPS guidance systems. We are starting to get them on farms and they are becoming popular, but it is not yet mainstream. That is pretty important.

The next thing I would move on to is pure precision farming systems, where this whole business of GPS in agriculture started. It started with things like yield mapping systems and variable-rate application technologies. That involved measuring the yield within a field with a combine or a self-propelled forage harvester recording the amount of grass that it cuts, producing a map to show how much was taken off in the various areas of the field and then using either that yield map or a map of soil nutrient status to apply nutrients variably across the field.

That was probably the first real iteration of precision farming that we saw in the market. For various reasons, it probably did not take off in the mid-to-late 1990s, when it first appeared. First, the equipment at that time was probably not particularly reliable. Secondly, there was not at that time, and probably still is not today, any good support for the end-user to show quite how they should handle that or where and why they should apply more. One or two small commercial organisations have grown up to try to do that, but again it is still at a low level. The agronomic decision support is not there for that. The other thing is that for the producer, the payback on the equipment to do it is not there. As a practice in itself, you could not justify buying the equipment purely to go out and do variable-rate applications of fertilisers. Even given the high price of fertilisers, it probably does not pay. That is potentially an issue.

Nevertheless, it is becoming a much more widespread practice. In the last four or five years it has become very popular, supported by the fact that guidance systems have become more popular on farms. The guidance pays for that equipment, and then that equipment can be used further for things like variable-rate applications. The equipment is paid for by other means.

There are also some new technologies that have come along that have helped to build the variable-rate application business. That covers things like sensing systems. For example, there are local sensing systems measuring the greenness of the crop using a sensor mounted on the fertiliser distributor or on the tractor itself, or maybe even from satellite images.

That is quite common particularly for nitrogen applications these days on larger farms. Stop me if I am running on a bit.

The Chairman: We probably should. We could probably keep you for four hours, so we have to be a bit disciplined.

Q694 The Earl of Caithness: Given that machinery is so vital to all farmers, can you tell us what has been the change in cost, in real terms, of agricultural machinery for farmers over the last 10 years?

Mark James: Probably not that great, if I am honest. If you asked a farmer, they would think that it had gone up dramatically. The majority of machinery used on UK farms today is built either in the United States or in the eurozone. Currency changes have seen some big changes in prices in the last few years, but generally speaking it has not gone up that much. I have checked and one of our 100 horsepower tractors, over and above the rate of inflation, has gone up in price by around 8% in the last decade. That is not actually that great, particularly when you look at fertilisers, for example, which have gone up by between 70 and 110%, or fuel, which has gone up 70% in the last decade and now represents the biggest cost to somebody operating a self-propelled machine on farm. I would also make the point that a lot of that change in the cost of farm equipment has been down to things like implementing emissions regulations, where we have all had it forced on us—the Tier 2, then the Tier 3 and now the interim Tier 4 emissions regulations. They have been very costly for manufacturers to implement on machines, and not all that cost has been passed on to the end user. That is where a lot of that cost increase has been. But generally speaking, compared to other farm inputs, it has not gone up that much.

Q695 The Earl of Arran: Presumably, the GPS system will not stop the operator going over the same bit of ground twice. It will not say to him, “Charlie, you have been here before”.

Mark James: It can do that. A typical system that we would have in a machine today would build a map of the field on the display in the cab to show the operator precisely where he has been in the field. Take it to the extreme and we could even steer the machine at the ends of the field as well. It will turn away from the work that it has already done and turn back into a fresh part of the field.

Lord Cameron of Dillington: And report back to the office.

Mark James: Yes.

Lord Cameron of Dillington: I should declare an interest here. We have John Deere tractors with the fully automatic system. You can look on the computer in the office and see what he is doing.

Mark James: I am glad to hear it.

Q696 The Earl of Caithness: Do you have any figures for how the new machinery is affecting productivity on farms? Productivity in Europe seems to have been fairly static over recent years, and yet you have all this new gadgetry.

Mark James: It depends a little bit on what we consider to be productivity. If we are looking at pure output, while there might be some small change I do not think it would necessarily be that great. But in terms of increasing efficiency and reducing input costs, there is a significant impact from this kind of technology. Typically, when used for seeding in the field there would be a 2-3% saving in seed costs, and the same in fertiliser costs because we are

Q697 The Earl of Caithness: A final question from me, when one looks at the UK and the big wheat areas of East Anglia, how economically justifiable is it for the small farmer to start investing in this machinery?

Mark James: It depends very much on how and where they start. One of the biggest mistakes that is made—this comes down to the type of communication that farmers receive—is that they are often advised that they should go for the highest accuracy of system and the most highly featured system available. That really is not the place to start. Start with a system that can give you a reasonable saving. A manual guidance system—a light bar that uses lights to guide the operator in the field—can give you 60% of all the total benefit that could be available from using a guidance system. The extra 40% or thereabouts can be had with an automatic system. The cheapest light bar system that you can buy is £800, whereas for an automatic system to steer the machine, you can go up to £10,000, £12,000 or maybe even over £20,000.

The farmer should choose the system that suits that operation that they need to work in. It can be very viable. For an arable farmer who is going to implement an automatic steering system on their farm—the kind of system you would use to go out and seed a field and to spray and spread fertiliser—you pay for that on a 1,000-acre farm in less than two seasons of work. The arable areas of East Anglia are where we have seen the most uptake of this kind of technology, but it is not necessarily where the biggest benefit could be. Grassland and livestock farming is an area that today does not even consider looking at GPS guidance systems. They dismiss it, and yet a 100-acre grassland farmer can pay for the cheapest type of manual guidance system in less than a season, just on spreading fertiliser. If they can pay for it in a season, then in the second, third, fourth and fifth seasons they are into profit. There are not very many investments that you can make in farming today that you pay for in that kind of timescale. It is quite significant, but I do not think the message has got across to those producers yet.

Lord Cameron of Dillington: If I could add to that, where you have small fields with slightly wiggly-edged boundaries is where it really pays off. It is very difficult to get it accurate when you have to steer crooked.

Q698 The Earl of Arran: Can you put a modern GPS system into an old tractor?

Mark James: Yes, that is no problem at all. For the low-level, manual guidance systems, all we need is a 12-volt power supply. We can plug in our display or light bar, or whatever it might be, and we will put a GPS receiver on the roof. It is very easy; it is a five-minute job to do it. Auto-steering it is a little bit more complicated. It depends on the age of the machine whether we would put in a built-in system, integrated into the machine, or add it on. We can pull off the steering wheel and put an electric steering system on that machine to steer it, almost regardless. For the basic systems it is really very easy.

Q699 The Earl of Arran: Our predicted rise in productivity output is pretty moderate—I think it is 4% in the EU, whereas Brazil is 40%, China is 26% and even North America is 10-15%. I think this is a rather unfair question, but can you comment on the

differing rates of agricultural productivity in different parts of the world. Does machinery play a part in these differing rates?

Mark James: I think machinery plays a part, but let us say that it is only one of the factors. The point to make about Brazil and to some extent about China is that they are investing very heavily in agricultural R&D. China has increased the level of investment in agricultural R&D from 0.2% to 0.8% of GDP, which is significant. Realistically, that is not happening in Europe. There is not that kind of investment in agricultural R&D. In some quarters they are talking about an R&D miracle in China and Brazil. They are really seeing results from that, and that is not happening in the European Union today.

China, in particular, is mechanising very heavily. I looked at some figures yesterday saying that only 60% of ploughing in China is done mechanically. The rest of it is done by animal power. Only 38% of harvesting in China is done mechanically. The rest of it is, I think, done by human power. They have a long way to go to catch up to where we are in Europe, where we are already highly mechanised. We are now looking for small, incremental gains that we can make by improving the level of mechanisation and the efficiency of the equipment that we already have. We have not got those big gains to make.

The other point to make, particularly with regard to Brazil, is that it has large areas of potentially croppable land that are not yet into production. We are not talking about rainforest areas; we are talking about areas that today are just not suitable for planting. They have large programmes to bring those land areas back into production. In Europe, most areas that can be cropped are cropped. We do not have that ability to increase our land area.

Another area, which is quite controversial and I would not claim to be any kind of expert, is genetic modification. In Brazil it is growing rapidly. They are already No. 2 in the world in soya production, but they are also increasing soya production. 70% of Brazilian soya is GM. That is a significant development. I think the same is true of the US, albeit the US is highly mechanised. They are benefiting to some extent from genetically modified crops. I know this is controversial.

The other thing about the US is that they have economies of scale. The largest average farm size in the world is in the US, which means that they can roll out much bigger equipment and they have lower input costs. In the mid-West of America, farming is very different from how it is generally in Western Europe. They will make maybe three passes across the field—one to spread fertiliser, one to sow the crop and one spray it—and then they will harvest. That is absolutely not the situation in Western Europe, where we might go six, seven or eight times through a crop of wheat and maybe 20 times through a crop of potatoes. The input costs and the economies of scale are of a completely different magnitude from what we have in Western Europe. I think it stands out that we have a unique situation in Western Europe, in lots of ways, which means that we are not able to increase quite to that extent at the moment.

Q700 The Earl of Arran: How long does the average farmer keep his tractor?

Mark James: If it is a mainline tractor, the one that they absolutely rely on to do the majority of their work, I would say it is around five years. After that, it will be relegated to second-line duties and replaced or traded in for another one.

Q701 The Earl of Arran: Are they paying up front or do they do it on a lease basis?

Mark James: The majority will finance or lease the tractor. Very few buy farm machinery outright these days. It does not happen very often.

Q702 The Earl of Dundee: You and your colleagues write about a correlation between farm income and constructive investment into innovative farm machinery. Would you like to tell us a bit more about that?

Mark James: I can only really speak from my own experience, but we have definitely found that at times when agricultural margins are tight, investment in this kind of technology has decreased. The example that I can point to is with regard to our sales of GPS-based equipment. You have to accept the fact that it is a growing industry anyway, but between 2003 and 2007 we were basically doubling our business on GPS-based equipment every year. Then we reached 2008, and 2009 particularly when worldwide we saw financial strictures, but for farmers input costs were very high—fertiliser prices were very high in that period, for example, and margins were very tight. For 2009, from having that stellar growth rate to start with, our business was back by 2% during that time.

To my mind, that does not make sense, because it is at times like that, when input costs are high, that we can mitigate some of that increase. Surely that is the time when you would invest in that kind of technology, if you could. Provided that the ability is there within farming businesses to do it, surely it would make sense to invest, yet that is not what they were doing.

My take on this is that somewhere along the line, my colleagues and I in the farm supply industry as a whole have not made a very good job of communicating to these end users what the benefits of that kind of system really are. If we had, maybe they would have continued to invest and would have reaped some of the benefits of reducing input costs a little bit.

There is that correlation and it is down to the perception of that kind of system in the minds of the producer. Some of them think that they are gadgets and toys. In the early days, perhaps they were, but today they are tools that you can use to reduce input costs. I am not sure that they are seen that way yet.

Q703 The Earl of Dundee: How far do you think that single farm payments already assist such investment? Whatever the incentive impact of current farm payments, in your view how could their ability to encourage investment in innovative farm machinery be improved further?

Mark James: Again, I would have to declare that I am not an expert on farm support systems, but like all people in the industry I have an opinion. My opinion is that if the current single farm payment system is an incentive to invest in innovative technologies, it is only a partial incentive at the very best. As a producer, if I was going to receive a payment that makes up part of my revenue regardless of my production output, why should I then invest money to increase output of a product when I am going to receive a payment whether I produce it or not, almost? That is a simplification—obviously you have to produce—but is it really going to incentivise me to invest money to produce it better? I do not think it is. At very best, it is only a partial incentive to invest money to produce crops better. That is my opinion.

While I am not an expert, looking from the outside at the US farm subsidy system, they are effectively subsidising production, in a way. By subsidising production, to some extent they really are incentivising methods of doing the job better—producing more and producing

products with a higher margin. Definitely, within the US market we see that the uptake of this kind of innovative technology has been much faster and much deeper than it has been in the UK. They are now looking at different technologies that we do not have available to us yet. So there is an example there that we can look at that maybe verifies that a little bit.

Again, I express my relative ignorance, but I would suggest that, going forward, if anything was done to link any kind of subsidy payments or the CAP to innovative technologies, it needs to be done in a way that is as simple to understand and as anti-bureaucratic as possible. The farming industry is snowed under today by paperwork, bureaucracy and administration. We need to add as little as possible to that. Perhaps there is a method where we could match-fund technology. Siphoning off a little bit of the payment that would be going directly to producers and using it to match-fund investment in technology might be a way forward.

Q704 The Earl of Dundee: It is interesting to hear about the American system. If it succeeds in being better and more comprehensive, might it also succeed in being simpler than what we have?

Mark James: It maybe could do that, yes. I am sure. That may be a way forward, with some kind of matched funding scheme. Whatever was done would need to be very accessible, very easy for the end-producer to understand and very easy for them to implement. Maybe there could be a menu of different options that they could buy into. We would want to put some flexibility into it. Maybe there could be an option available for some slightly more advanced, larger farming businesses to move into different areas. Particularly, if we wanted to get livestock and grassland farmers involved, it would need to be simple. That is an area where development in this kind of technology today is seriously lacking.

Q705 Lord Cameron of Dillington: I would like to move on to farm advisory services. One of the issues throughout this investigation has been the lack of agricultural extension, particularly in England—not so much in Scotland, with the SAC and so on. You said earlier this morning that “agronomic decision support is not there”. I think we would agree with that. I know from personal experience—I have already declared my interest—that John Deere has fairly extensive training programmes for farmers who buy their equipment. You might like to comment on that. I just wondered whether you would like to comment on how you see the innovation support, agricultural extension, knowledge transfer and knowledge exchange operating in the UK. How could it be improved, given that the Government has no money? What is the answer to this problem that we have?

Mark James: That is a thorny question. Looking at what we do as a company, I declare straight away that we are a commercial business. We get the majority of our revenues by selling farm machinery. We are not an advisory service as such, albeit we have done quite a lot of market research that proves that the agricultural dealer salesperson is a distinct knowledge source for the end-user. They are doing a sterling job in advising the farmer and the end-user.

As a company, we have training facilities. Effectively, we train our dealers almost 365 days a year. We also have some advisory capacity in-house. Working along with me we have four crop system specialists who cover different areas of the country. They are experts on this kind of technology. They will go out and advise the end-user on the kind of equipment that they should be using and looking at. Once they have that equipment, they help them to optimise it in the field. We have also done quite a lot of work training specialists at our dealerships so that they have the same kind of expertise as our own people will have, so that

they can advise the end-user as well. On top of that we do customer clinics and customer days. For example, during the spring we have had what we call Green Efficiency Days, when we advise operators how to drive the machines and get the best out of them.

That is what we are doing as a company. As regards the extension services out there in the field, I have to say that in 10 years in this role I cannot remember the last time I came into contact with anybody from a publicly funded or supported extension service. They are just not there. That is a problem. That gap has been filled, effectively, by commercial organisations, who generally have an axe to grind, a little bit like us. They have a product to sell. But they are the people who are, to some extent, doing the basic research. They are supplying the information to the end-user, so there is a gap there for some independent advice for the end-user, the farmer. This is really necessary. The communication to the end user has probably not been all that good in some respects, because it has a commercial bent to it all the time. There is absolutely a need for something like that.

We need somehow to try to set up some kind of body that is independent and can help to raise awareness of different technologies to the end-user. I would be open to suggestions on where that should be led from, but people like BBSRC or NIAB-TAG, (The Arable Group), could be contracted to do this, or people like the HGCA, which did a sterling job a couple of years ago with the Be PRECISE initiative, which was a series of workshops and online tools that you could use to learn about precision farming technologies. But of course that leaves out the important livestock sector again, which needs some representation. Some kind of group like that, led by that kind of body—NIAB-TAG or HGCA—and incorporating stakeholders from across the industry, from machinery manufacturers and producers, could together come up with some campaigns that we could use. To some extent it will need some kind of advertising, but it probably means nothing more than training, workshops and operator clinics to raise awareness. That is what we really need within the industry. To some extent, the small commercial organisations are filling the gap today, but there is a need for an independent body as well to get that information across.

Q706 Baroness Howarth of Breckland: I am interested in whether you think that people become sceptical about machinery. If they do not have independent advice and are a bit uncertain about using machinery, is there a cultural issue among farmers about not moving forward? If they had someone alongside them who was identifying their needs and their particular way forward, might they innovate at a faster rate?

Mark James: I totally agree that that is the case. To some extent, that is the issue that we have right now. I declare my interest. I am to some extent employed to sell equipment, and yet I feel that an important part of my job is to advise the end-user on the right way to go and the right strategy to employ. There is undoubtedly scepticism among those end-users. They see us as being someone who is going to make them sign on the dotted line and buy some equipment.

Q707 Baroness Howarth of Breckland: We all know what we feel about IT. Is someone trying to sell you a gizmo that you do not need and you will not know how to use? Do you think that some independent advice would help? You would probably sell more.

Mark James: I absolutely agree that it will. I totally believe that innovation should be at the heart of the CAP. We should be aiming to build a healthy and strong agricultural industry that can compete on the world stage, but unless we can roll technologies out quickly and deploy them, that is not going to happen. That requires some kind of independent advice for

the farmer to get that information out there and build the confidence that it is a product that can do the work for them.

Q708 The Earl of Dundee: To counterbalance such scepticism, which farmers may naturally have, which other countries within the European Union—you have mentioned the United States—may already have independent bodies that can inform farmers?

Mark James: I have to say that I would not be hugely aware of what happens in other EU countries, but I know that Germany has a strong, Government-funded body called the Julius Kühn Institute (the JKI). It does all the independent regulation and testing for sprayers, for example. A sprayer in Germany has to be JKI-approved before you can even put it on the market for sale. They have that kind of body. We in the UK do not today.

Q709 The Earl of Caithness: How compatible is this machinery? It is okay to get the farmer to decide that he has to go into GPS, but the moment I have bought one piece of John Deere equipment, I am hooked into John Deere for ever and a day and you are going to sell me something bigger and better next year, and the year after, because it is not doing quite what I want it to do. In the rest of the market I could go out and get an equally good bit of equipment from somebody else, but it is not compatible with what I have got from you.

Mark James: For sure. I have to say that that is a common occurrence. The situation today is probably better than it was a few years ago. Systems that are six, seven or eight years old are maybe not as compatible as they could be. Older machines—not just GPS systems, but application equipment, sprayers, fertiliser spreaders, tractors or whatever they may be—are probably not as compatible as the ones of today. From John Deere's point of view, we are strongly working towards international standards. We like standards. Lots of people in our industry do not like standards, but we do, generally speaking, because we think that that guarantees the end-user a level of performance and compatibility. One of the standards that we work towards very strongly is ISO 11783 ISOBUS standard. ISOBUS is a standard that means not only compatibility with GPS systems, but compatibility with machines in general and compatibility between machinery in the field and IT farm recording, planning or mapping systems. That standard incorporates regulations and guidelines for the connection of the machine to the vehicle and then for the data transfer from the vehicle back to the farm office. I would say it is getting better and we as a company are strongly working towards that. There are some companies that are not working towards it or have been very slow to move towards that standard. The majority of the major worldwide manufacturers of agricultural prime movers are now on board with ISOBUS and are working towards it. Of the implement manufacturers, today they are generally working towards the aim of ISOBUS and compatibility between different machines. It has been a lot slower than it was with the major manufacturers, but it is definitely coming. Things are not perfect, but they may be getting better.

Q710 Baroness Parminter: I have two questions. The first is around agricultural knowledge systems. When you come up with your ideas for a new product, how does that come about? Who are the decision-makers, not just in your company? What advice do you take from other organisations or bodies or farmers to come up with these ideas?

Mark James: That is a good question. Obviously, we absolutely adhere to every possible rule and regulation that might affect our machines. On every project team there is somebody who would do that. But I am not sure that we would involve many people from outside organisations, other than on a consultative basis. We do a lot of visiting farmers,

operators and end-users to find out precisely what their needs are. It is pertinent that I have spent the last two weeks doing exactly that, doing nothing other than visiting farmers and asking about what their problems are and what solutions they might want or see so that we can build a picture of where the bottlenecks are in the system for the farmer.

From that we will come up with what we call a market opportunity. At that stage we have not made a decision that we will build a product—we have not decided at that stage that we will build a new 200 horsepower tractor, but we have maybe found out that the farmer has a need to fulfil. From that we will look at what the possible solutions might be. We might decide to build a new tractor, but we might also decide to do something else.

Again, I am not sure that we have too many outside inputs into that, but as a company we listen very strongly to our customers and to the end-user and we try to build a solution that meets their needs, and hopefully at a price that they are willing to pay, because that guarantees, to some extent, that what we are building is close to the market and we hope it will be successful. It is a complicated process and that is a very simple précis of it. It has around a thousand different steps and at multiple steps we will be going out to the field to talk to end-users to decide if this solution is going to meet their needs. It is purely based on that.

Q711 Baroness Parminter: I am not an expert in farmyard machinery—I get all my advice from *Countryfile*. Over the last couple of months I have seen trends in the UK where, because of the expense of the equipment, farmers have been coming together to purchase or lease it. We are doing a study across Europe, where there are smaller farmers. I am interested in what you see as the potential for delivering greater benefits to farm productivity across Europe when there are so many small-scale farmers. Do you think the model that I have seen on *Countryfile*, where people are coming together, is replicable across Europe and therefore there are still quite a few benefits left to be achieved in this area?

Mark James: I think that it is replicable. It absolutely is and it should be. Co-operation between farming enterprises is to be encouraged in every way. There is scope to do that. I go back to what I said earlier. It is about those groups of farmers and small co-operatives implementing the kind of technology that will meet their needs and not allowing themselves to be pushed into implementing some expensive technology that is never justified. That is the key. Again, it comes down to the advice angle. There is a large potential for doing that. In the UK, we have seen a lot of consolidation in farming. Farms have generally got bigger and because of that they can implement more technologies and are generally more businesslike. That is not the case in all of Western Europe and other avenues will definitely need to be explored, of which co-operation should be one, to make sure that we can roll out these technologies across the whole of Europe and build a healthy and strong farming industry, which is what we all need.

Q712 Baroness Howarth of Breckland: I am interested in education and skills and how education changes attitudes and culture and therefore helps towards innovation. You make some very interesting points. One particularly interesting point was about more complex systems demanding an operator with a higher level of skills than can reliably be found on the farm today. I wonder if you could say a bit more about that and about how that could be developed. Are there NVQs or other systems that could be developed on-farm at operator level? Could you also say more about the possibility for students from universities or colleges feeding agriculture to be exposed to the latest technology? We have heard a lot about the way that we are losing students in our colleges and our universities are diminishing in this area. We wondered if you had a view on that.

Mark James: Finding staff with the right kind of skills and the right attitude and enthusiasms to operate this kind of farm equipment and, from our point of view as a manufacturer, to work in our dealerships to support this kind of equipment, is a growing issue. It is becoming a major problem for us, because of several things. First, older operators on machinery generally did not grow up with computers. They did not work with computers at an early age and they may not be familiar or confident with them. If those kinds of operators are willing, they can learn just as well as everybody else and can use the systems, but it is really a matter of being willing to learn, and sometimes they are not. With younger operators that is not a problem, generally speaking. You are absolutely right that we need to encourage younger people to come into the industry and we need to encourage those older operators to engage with the equipment. To some extent, it is a matter of gaining their confidence. It is a matter of training, really. That might be NVQs and those kinds of things, or it might be training that the producer might invest in, or training that the machinery dealer or supplier could put on for these operators. We need training to increase the confidence level of these operators.

The other thing that we need to do, one way or another, is to encourage more young people to get into this industry. It is going to be vital in the future and it is becoming a problem. The agriculture industry at the sharp end—working on farm machinery or in a farmyard—is not a very attractive proposition for lots of young people, because of various things. Often, the conditions are not that great and the pay scales are not very enticing. On lots of farms there are no opportunities for advancement at all. These all need to be addressed. We need to try to work towards better conditions for operators and farm workers and build some kind of recognition system. We have been trying to do that in the supply industry with the LTA scheme—the Land-Based Technician Accreditation scheme. We should continue to do something in the agriculture sector itself—some kind of accreditation or recognition scheme for farm workers and operators that points out when these guys have got to a certain skill level and rewards them for doing that. In the past we have had these, such as the ordinary agricultural workers grades and craftsmen grades, which are all going by the board now, to some extent. That is disappearing. There needs to be some kind of recognition system to do that and to get young people into the industry. We are going to need that in the future. It is going to be key to us, really.

Q713 The Earl of Dundee: Following your interesting comment there, to what extent would you favour a joint initiative between business and Government to link to agricultural colleges in this way so that there is a much more automatic incentive than now for students to be taught to get up to date?

Mark James: I would strongly support it.

Q714 The Earl of Dundee: How would you put it together? How do you envisage working a joint initiative between Government and businesses?

Mark James: From the point of view of a manufacturer, we would be very happy to hold lectures and workshops for agricultural students and people working in the industry. To some extent, we would be happy to loan equipment so that agriculture students could learn about the products. In a small way we do that now, but there is no reason why we could not extend that. It would definitely be valuable for us all, for the industry as a whole. The NPTC—the National Proficiency Test Council—has a role in this as well. Maybe a qualification in precision farming could be developed. I think Lantra has a role to play as well. As a manufacturer we would be happy to support it and I personally would be happy to get involved to create workshops and clinics and these kinds of things that we can do to try to

Q715 Baroness Howarth of Breckland: This is a different point, but I wondered what your view was. Do you think that, with the future holding a problem of food security and with food production becoming more important as the years go on, there will be some way in which we could gain the enthusiasm of the younger generation into farming through some of that work? I am thinking very much of the FORESIGHT Futures Report, which we have all just had.

Mark James: I think we can. It comes back to the point about awareness and communication. We need to promote the agriculture industry as a high-tech industry. I am not sure that it is seen as such in many quarters. I think we can do that and it is very important that we should. I agree that that is a point that we can make. It needs some work and some communication and it will help to get younger people into the industry. But we should not forget that getting them into the industry is one thing. Once we have got them there, we have to retain them. That also requires us to look at the working conditions and pay scales, unfortunately, to make it an attractive industry to stay in. That is important.

Q716 The Chairman: That is tremendous. Thank you very much. Just one final question: in the important issues of the productivity gains available if you could roll out the precision farming technology, could you direct us to any independent studies? I am sure that your data is good, but looking beyond that, is there a university, here or in the United States or anywhere, that has undertaken trials that conclusively prove these points?

Mark James: There are various places. The University of Wageningen in Holland are doing quite a lot of work on this. The University of Leuven in Belgium is doing quite a lot of work and the University of Illinois did a lot of work on this as well. They are the main places that I would be looking at. Simon Blackmore, who is just becoming the new head of Engineering at Harper Adams College in Shropshire, has done a lot of work on precision farming. Nanorobots in agriculture is another of his areas of speciality, I seem to recall. That is good news for the industry, but also an interesting source for information and knowledge.

Q717 Lord Cameron of Dillington: What is a nanorobot?

Mark James: It is a tiny robot, almost microscopic.

Lord Cameron of Dillington: That does what?

Mark James: It can do all kinds of things. It could remove diseases from crops, or all sorts of things. That is only one area of his speciality. He also looked at things like direct injections of chemicals into sprayers, which is another interesting area of technology. As I say, precision farming is a broad church.

Q718 The Earl of Caithness: I just wanted to follow that up. What is over the horizon? We have talked a lot about what is available now. What do you see in 10 years' time as making a difference in farming?

Mark James: Lots of things, really. In the very short term, we are going to see systems where you can see what the machine in the field is doing. You can then program that machine in the field. We could upload software to the machine in the field now, almost. We could schedule the operator's work in the field and tell him where he needs to go. We can send him an application plan for a variable rate spreading or spraying job over the air. That is going to come very quickly. Probably one of the next things, which is just starting to be

rolled out now, is synchronising machines together. Imagine a combine operating in a field and we want to unload the grain from it. We have a system that is just being introduced where, as soon as the tractor and trailer drive into the field, the combine senses that it is there. If there is more than one combine, the operator on the tractor will be able to see which one has the fullest grain tank. Then he presses a button and lets go of the steering. The tractor steers itself alongside the combine, synchronises its forward speed with the combine automatically and then it starts to unload. It takes the workload away from the operator.

The next logical step from that is multiple machines in the field operated by one high-grade operator. It might be where we are planting root crops, for example, and there are three operations to get that crop in the ground. There might be three tractors working in the field and one operator. You then see the importance of having a high-grade operator in that machine. It is vital for future technology. One driver could operate those three machines and effectively do three passes with one set of labour. Taking that to the ultimate step, something that has been under development but not launched is a fully autonomous vehicle. From a computer terminal in the farm office we set the machine off to go and do a job. It heads out to the field, it does that job and it comes back at night. We will see that.

The Chairman: Thank you. That has been tremendous. Your enthusiasm is much appreciated.